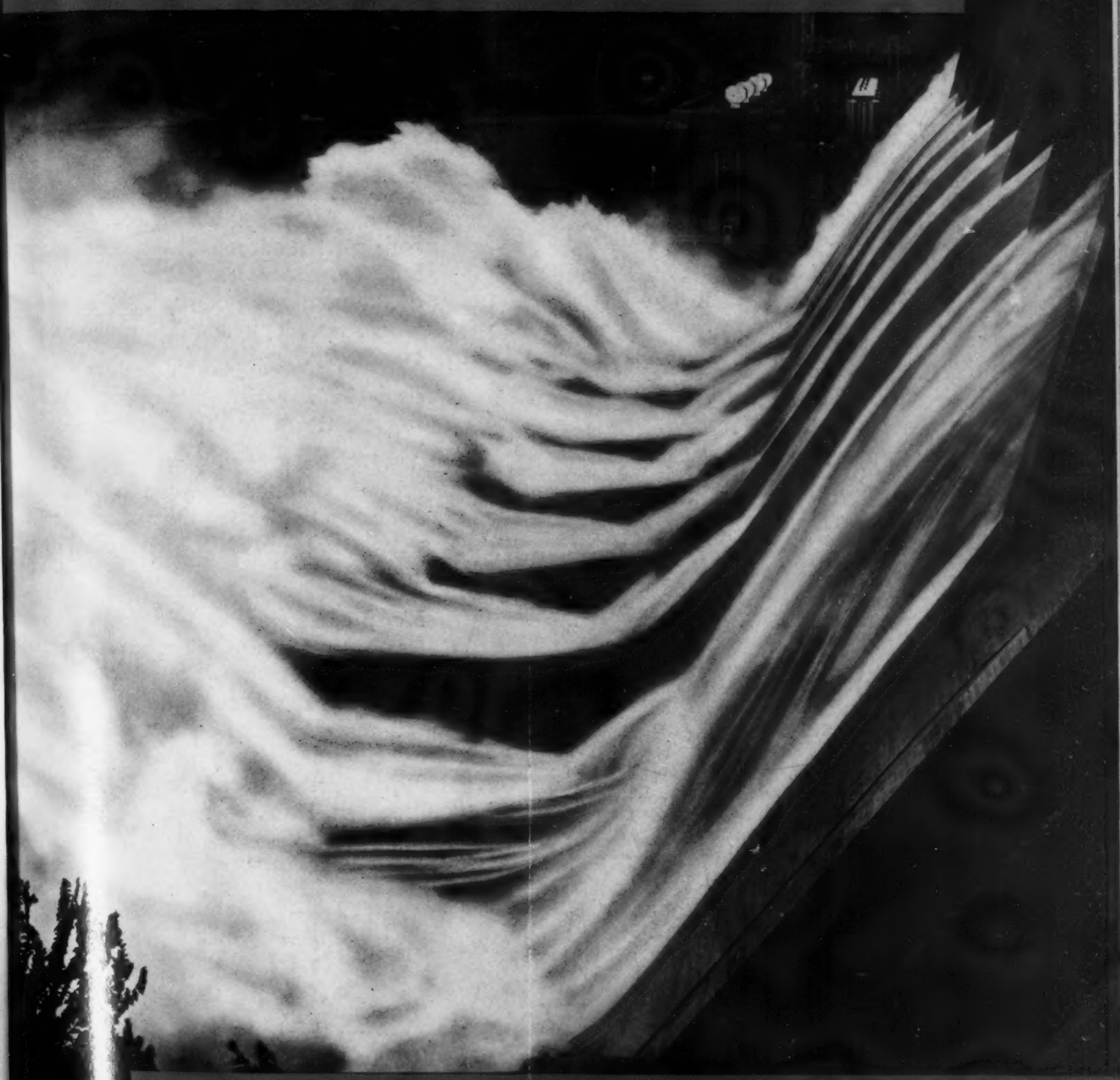
Electrical World

MARCH 22, 1941



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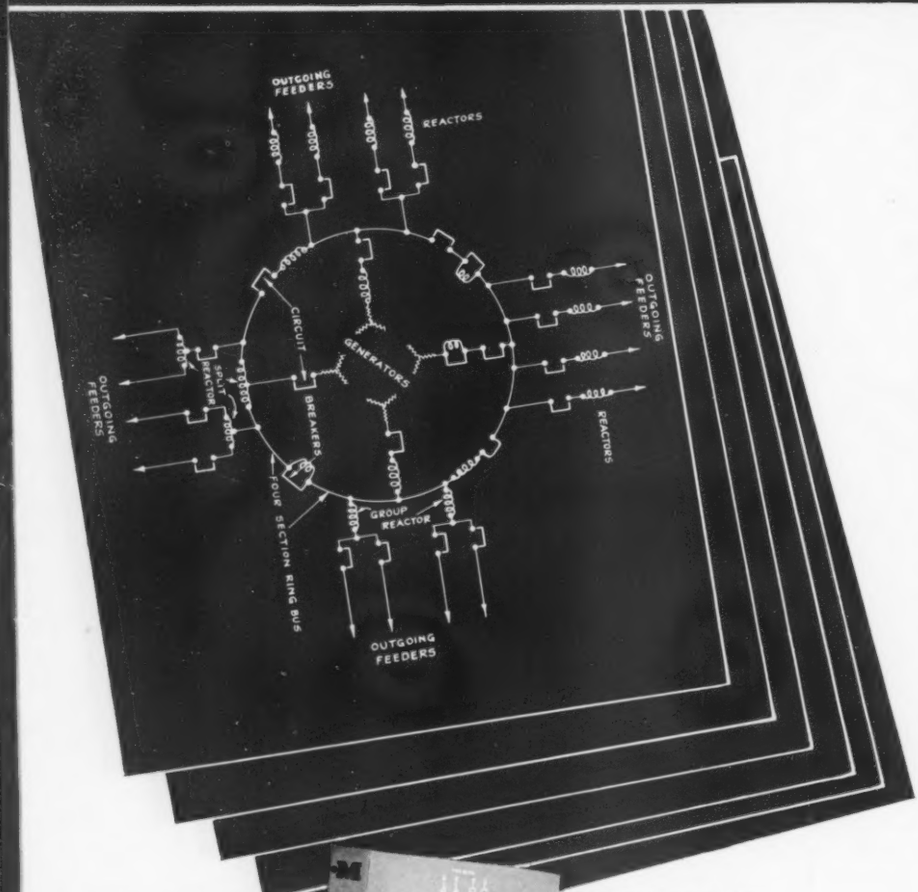

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March 22, 1941

Contents

Vol. 115, No. 12

Liquid Nitrogen Locates Cable Oil Leaks 52
F. P. WEST and C. J. SMITH, *Consolidated Edison Company of New York, Inc.*

Effective Employee Training by "Rehearsed" Conferences 55
ALFRED M. COOPER, Banning, Calif.

Mercury Vapor Extends Life of Steam Sites 56
A. R. SMITH and E. S. THOMPSON, *General Electric Company*

New Transformer Lowers Copper Loss, Improves Regulation 60
J. O. FENWICK and D. E. WIEGAND, *Line Material Company*

Reclosing Breakers or Reclosing Fuses—Which? 62
H. A. P. LANGSTAFF, *West Penn Power Company*

Loop Helps to Serve Growing Load 65
E. B. HORNBAKER, *Southern Colorado Power Company*

Commercial Cooking Program Yields $50,000 E.A.R. 66
G. F. WATTERS, *Buffalo Niagara & Eastern Power Corporation*

Electrical Features of Claytor Hydro Plant—II 68
PHILIP SPORN and H. A. KAMMER, *American Gas & Electric Service Corporation*

Carter Field on Washington Events 74

News of the Week 76

Editorials ..... 51 and 72
Field Operating Practices 84
Industrial Engineering 94
New Engineering Ideas 98
Load Building 104
New Equipment 108
Manufacturing and Markets 112
News About People 116
Sales Opportunities 133
Rural Allotments 134
Recent Rate Changes 134
Legislation 136

Index of Advertisements 142

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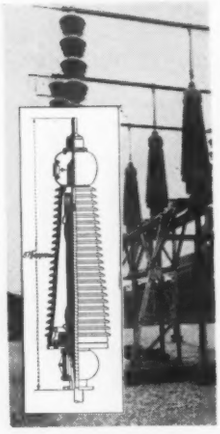
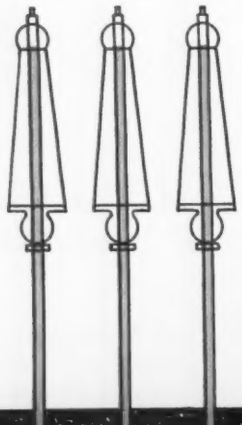
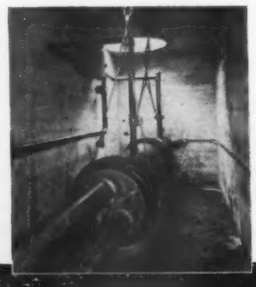
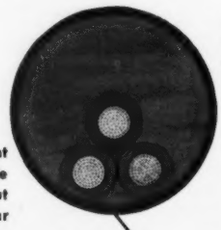
All-porcelain high tension terminals specially designed with double oil chambers — oil remains under pressure to top of terminals.





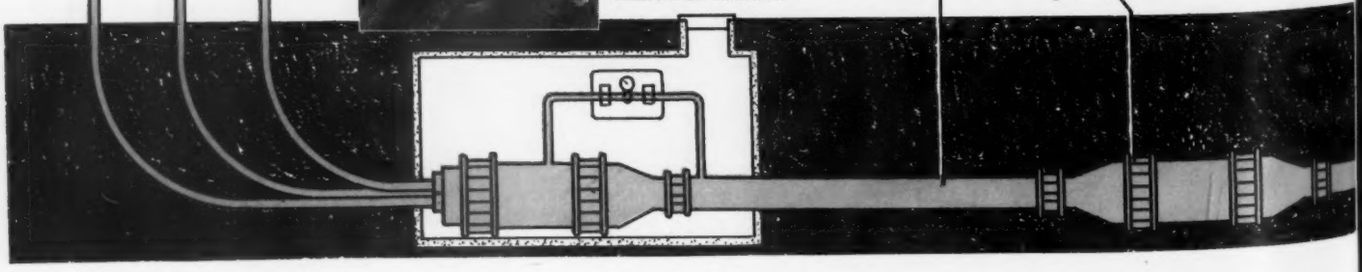


Trifurcating semi-stop joint (may be placed in manhole if desired) for bringing out single phase leads near base of terminals and isolating terminal section from main transmission line.



Insulated, stranded conductors in heavy welded steel pipe filled with oil under 200# pressure. Lengths of cable up to 4,000 feet may be pulled in if necessary.

Simply constructed joints of bolted or welded type may be required at intervals of 1,500 to 2,500 feet, depending on conditions. These may be buried directly in the ground.



All for Defense

"I ask you to consider the needs of our nation at this hour, put aside all personal differences until the victory is won." This sentence was taken from President Roosevelt's radio talk a week ago.

This is the pleading of our Chief Executive for national unity, for unwhimpering sacrifice, for eager and cheerful co-operation, to the end that democracy shall not vanish. Every true American believes in that policy and accepts it wholeheartedly.

At the same time, those in Washington who are a part of or are working for the Administration should be asked "to consider the needs of our nation at this hour" and to "put aside all personal differences." The shameful fight of the government in Spokane before the March 11 election, for instance, should never have a place in a democracy where the people are supposed to instruct their elected representatives instead of the other way round, and least of all now.

When men and women making pie plates and other cooking utensils are to be thrown out of work because of aluminum shortage is no time to deny Bonneville power for aluminum production simply because it is needed for municipal ownership in a community where it is not wanted.

When factories are working to the limit to turn out turbines that will carry load this year and next is no time to start operations on the St. Lawrence—a project that cannot possibly have any defense value and which has all the earmarks of being promoted for personal reasons.

The President said that all would be called on for sacrifice. He will find the country behind him. Sacrifices, however, must not be one-sided. They must come from all. Business will have to pay more taxes, be content with much less profit and be subject to greater regulation. The individual will pay more taxes and will have to do without certain things that once were plentiful. At the same time government should understand that this is no time to try to take advantage of an aroused patriotism to sneak by programs that have no defense value. They, too, must sacrifice.

And, finally, labor. The President said: "You will have to work longer at your bench, or your plow, or your machine, or your desk." This wil be done willingly, in fact gladly by those who will share in overtime. It was in another statement that we were much more interested: "It (defense) must not be obstructed by unnecessary strikes of workers."

The word "unnecessary," it seems to us, is extremely unnecessary. No group of men should be permitted to delay the defense program for any reason. The Governor of Michigan had the right idea when recently, in the face of another Consumers Power strike, he threatened to keep the property operating.

Labor is entitled to the wage it earns, to good working conditions, to collective bargaining, to organization if it desires, but it is not entitled to the right to sabotage our defense program in any manner whatsoever. There can be no such thing as a "necessary" strike on a defense operation.

Everybody has to work together—business, government, public, labor. Anybody who tries to take advantage of this situation to promote his own pet theories or personal interests unfairly is a slacker of the first water.

Liquid Nitrogen Locates Cable Oil Leaks

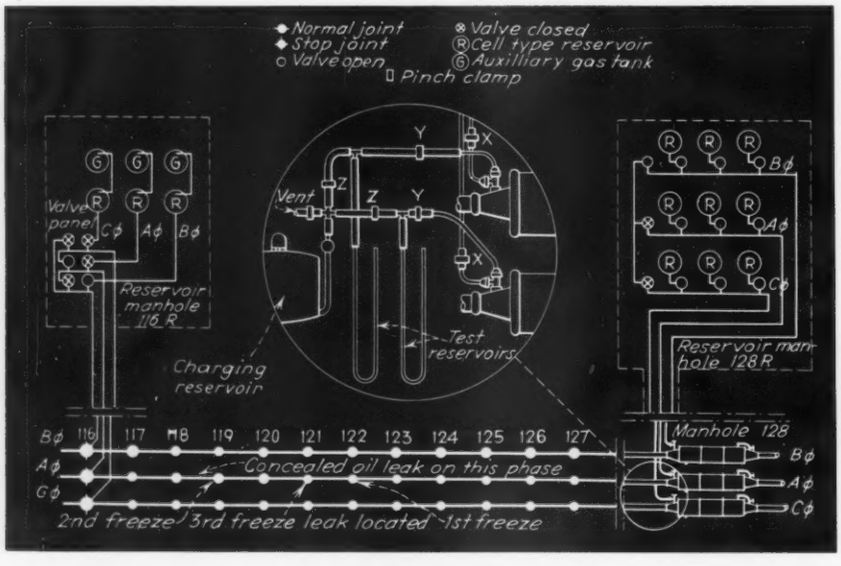
Congealed oil at strategic points acts as stop joint to sectionalize cable loops in search for leaks not detectable at manholes

F. P. WEST and C. J. SMITH,† Consolidated Edison Company of New York, Inc.*

DURING the past 18 months the Consolidated Edison System Companies in New York have located several troublesome oil leaks in high-tension cable by freezing the cable with liquid nitrogen. This method has been applied to both the oil-filled and solid types of cable.

* Electrical engineering department.
† Electric distribution construction dept.

A typical layout of an oil-filled feeder section between stop joints, including the oil supply system, is shown in an accompanying illustration. This section is one of fifteen sections of a 12-mile, 132,000-volt, three-phase transmission feeder, consisting of three single-conductor, 600,-000-circ.mil $\frac{3}{4}$-in. hollow core cables in the same duct bank. Each phase of the section referred to consists of twelve lengths of cable between manholes which are spliced to each other through normal joints and to the adjacent feeder sections through stop joints. Feeding-type oil reservoirs are connected to the upper end and balanced pressure type at the lower end, both through valve panels.



TYPICAL oil connections to three oil-filled cables in the same duct bank while locating leakage by freezing cable with liquid nitrogen

The elevation at the left end is 38 ft.; at the right end (4,390 ft. distant) is 50 ft.; at 2,785 ft. the elevation is zero.

In normal operation the oil supply to each phase is segregated, but in case of necessity the valving arrangement permits connecting oil supply of one phase to either or both the other phases at either end.

For locating a leak in phase A the valves and freezing are arranged as shown above.

The manometers in the encircled sketch provide a sensitive means of measuring oil loss by pressure changes. They also serve as an oil seal and oil supply to the cable.

From the standpoint of locating oil leaks, the system described above may be divided into two parts, namely, the part within the manholes and the part within the ducts. Leaks within the manholes are found by inspection. If a leak occurs within a duct on one phase only and oil runs from the duct into the manhole, the location is also determined by inspection. However, when there is no visible evidence it is assumed that the leak is within the duct and the oil is escaping through the duct bank into the ground.

Accurate and Quick

Besides being accurate, it is desirable that any method of locating such leaks be as rapid as possible in order to reduce to a minimum the outage time on the feeder and also one that will permit returning the feeder to service on relatively short notice. After a trial of several methods with unsatisfactory results a method was developed through the use of temporary stop joints made by freezing the oil with liquid nitrogen applied to the cable sheath.

The method consists essentially of connecting a sensitive test reservoir to each end of the leaking section and

closing off the permanent oil reservoir supply. An initial rate of oil loss is determined. The cable is then frozen at approximately the midpoint between the ends of the section and the changes in oil loss observed. If there is only a single leak the reservoir which supplies the entire oil loss after the "freeze" indicates the side of the "freeze" where the leak exists. A complete thaw is indicated by a return to the initial rates of oil loss. By freezing the cable after each move at approximately the midpoint of each remaining portion of the section in the direction that the leak is indicated the location of the leak is determined.

Test Reservoirs

In the specific case which will be described later the two sensitive test reservoirs were placed in the same manhole for convenience and ease of control. One reservoir was connected directly to the phase containing the leak and the other reservoir was connected to the other end of the leaking phase through another phase which did not contain a leak.

In the several sections of oil-filled cable in which the location of the oil leaks were determined by this method the rates of oil loss varied from approximately one to ten quarts per week. These rates on a short time test measurement basis ranged from approximately 0.5 to 5 cu.cm. per five-minute period, so that a sensitive means of measuring the rate of flow was required. Mercury manometers, each made with two glass tubes one meter in length and 7 millimeters inside diameter, were used as reservoirs. Each manometer was connected to the oil system and a charging reservoir with rubber tubing, using pinch clamps at points "Y" and "Z" for control.

An initial pressure was established in the manometers from the charging reservoir. This pressure was selected to give as great a pressure and consequently as great an oil loss as possible with the existing contours, without imposing an excessive pressure on any part of the system. As each manometer was connected to the respective cable the lines to the section reservoirs were closed off by closing the clamp on the temporarily installed rubber tubing at point "X."

Loss Rates Established

With the rates of loss mentioned above the change in manometer readings was from approximately 15 to 150 millimeters per five-minute period. Prior to freezing the loss was divided between the two manometers, but as the freezing progressed the division of oil supplied by the two manometers changed in accordance with the location of the leak. If all of the leakage was on one side of the "freeze" all of the loss of oil would shift to the manometer feeding that side. With a complete "freeze" constant rates of loss were established. The change in manometer readings

TWO-PIECE sleeve makes freezing chamber

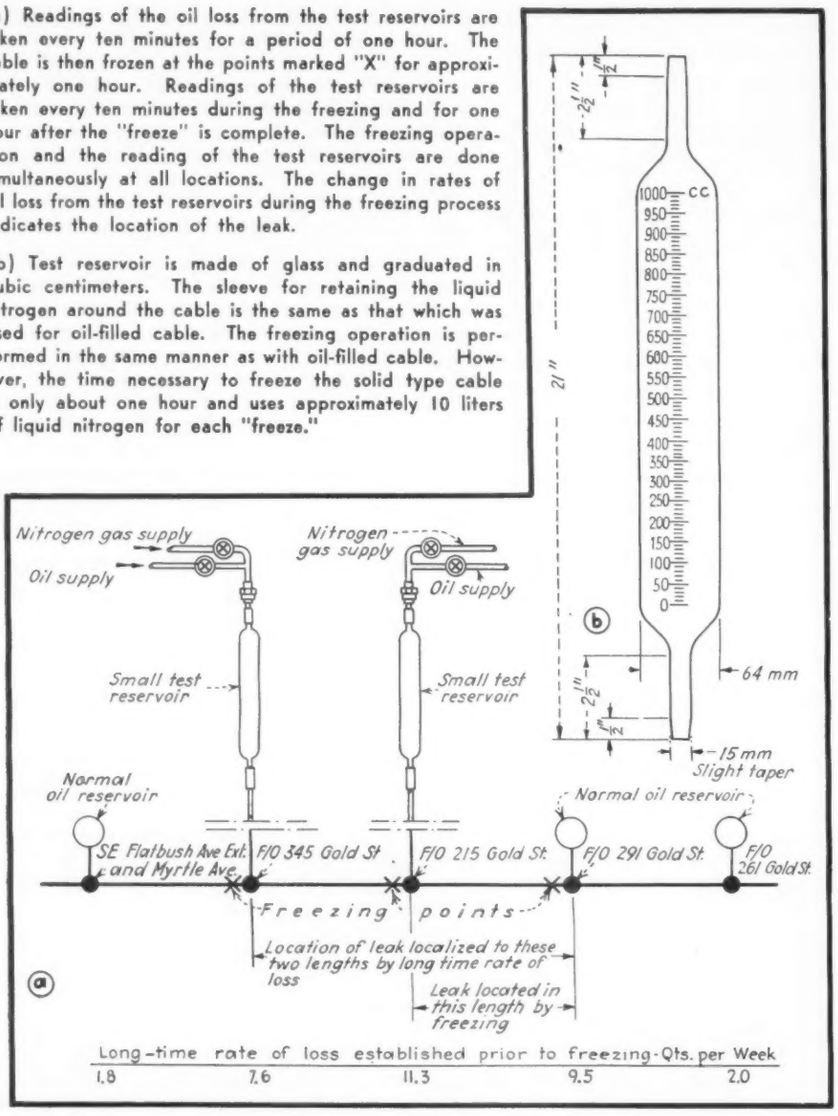
(a) A 9-in. length of galvanized iron pipe is cut in two longitudinally and the edges surfaced for tight joints. Brass strips were fastened on both sides of both edges of one half and the resulting groove provided with hair-felt gaskets. Sponge rubber cushions were provided on the inside at each end of the sleeve to facilitate centering the sleeve on the cable.

(b) Two pipe outlets were provided in the top half, one through which liquid nitrogen was poured and the other through which the height of the liquid nitrogen was observed and from which the evaporated liquid nitrogen escaped. After removing the arcproofing from the cable the assembly could be quickly placed in position. The sleeve was designed to provide a space of approximately ½ in. between the cable and the inside of the sleeve. After the sleeve was placed in position, the longitudinal joints and the joints between the cable sheath and the ends of the sleeve were packed with a duct-sealing compound to prevent the leakage of liquid nitrogen.

(c) After strapping a quilted hair-felt blanket around the sleeve for heat insulation the sleeve was ready for use. Liquid nitrogen was poured into the sleeve, keeping the cable completely immersed until the desired test observations were made. The blanket was removed for the thawing operation.

(a) Readings of the oil loss from the test reservoirs are taken every ten minutes for a period of one hour. The cable is then frozen at the points marked "X" for approximately one hour. Readings of the test reservoirs are taken every ten minutes during the freezing and for one hour after the "freeze" is complete. The freezing operation and the reading of the test reservoirs are done simultaneously at all locations. The change in rates of oil loss from the test reservoirs during the freezing process indicates the location of the leak.

(b) Test reservoir is made of glass and graduated in cubic centimeters. The sleeve for retaining the liquid nitrogen around the cable is the same as that which was used for oil-filled cable. The freezing operation is performed in the same manner as with oil-filled cable. However, the time necessary to freeze the solid type cable is only about one hour and uses approximately 10 liters of liquid nitrogen for each "freeze."



OIL LEAKS in solid type cable also located by freezing with liquid nitrogen

which occurred during the "freeze" changed in the reverse order as the thaw progressed, which was a means of determining when the thaw was complete.

Experience

This method was first applied to 132-kv., single-conductor, 600,000-circ.mil oil-filled cable having a $\frac{3}{4}$-in. hollow core. The feeder was removed from service for approximately eight hours before any measurements were made, in order to permit the cable temperature to become stable and thus reduce to a minimum the movement of oil due to temperature changes. Because of the low rates of oil loss to be measured it was extremely important that the test reservoirs supplied oil only to the leak. It was found necessary to disconnect any balanced pressure type reservoirs from the cable being tested and to make certain there was no passage of oil through a closed permanently installed valve.

Because of the necessity for taking the foregoing precautions, the time required to establish the initial rate of oil loss varied from four to ten hours, depending on the local conditions in the particular section under investigation. In order to provide a complete "stop" in the cable it was necessary to freeze the cable for approximately two hours and to maintain the freeze for about one-half hour longer to allow a check on its effectiveness.

The thawing operation was completed in an average of $1\frac{1}{2}$ hours. Approximately 25 liters of liquid nitrogen was used for each "freeze."

Referring to the feeder section illustrated three "freezes" were required to locate the defective cable, as indicated. In the longest feeder section to which this method was applied the leak was located after six "freezes." Troublesome oil leaks were located in this manner in five feeder sections, where other methods had failed.

Solid Type Cable

In a typical layout of a portion of a 27,000-volt, three-conductor, paper-insulated, lead-covered cable system in a congested area the cable joints are filled with oil supplied from reservoirs, with several joints usually connected to each reservoir. Since there are normally no stop joints installed in the solid type cable, a leak in the cable sheath is supplied with oil from reservoirs in several manholes in the area.

In order to determine which cable contains the leak it is necessary to isolate the cables on separate temporary reservoirs at the reservoir locations which have shown an abnormal oil loss. After finding the particular cable which is leaking by taking routine readings on the oil reservoirs the exact location of the leak between two manholes remains to be determined. It is for this purpose that the method of freezing the cable with liquid nitrogen is applied.

Method for Solid Cable

For solid type cable the method differs somewhat from that which is used on oil-filled cable. The number of cable lengths on the feeder in trouble have been reduced to two or three adjacent lengths by preliminary tests. Having established a long time rate of oil loss, the feeder is removed from service. It is assumed that the transfer of oil because of temperature change has been stabilized sufficiently for further tests after a period of eight hours. A more sensitive determination of the rate of oil loss is made with small test reservoirs attached to the cable joint at the selected manhole locations.

This method has been applied to 27,000-volt, three-conductor, 350,000-circ.mil and 500,000-circ.mil, paper-insulated, lead-covered solid type cable.

Up to the present time it has been utilized to locate oil leaks in 23 areas with satisfactory results.

Effective Employee Training by "Rehearsed" Conferences

Foremen and other work supervisors quickly become competent as employee conference leaders and accomplish better and faster results than can a formal training staff

ALFRED M. COOPER, Banning, Calif.

ORDINARILY employee training conferences are conducted by conference leaders employed specifically for this work. Of late, however, it has been found that equally effective training conferences can be conducted by the employees' own supervisor, providing only that he or she be given some instruction in the technique of directing discussion. Results from trials of this new method indicate that the final effect of such training is better, and the carry-over to the job stronger, when employees in training meetings are led by the supervisors with whom they work every day than is the case when staff training men lead them.

The writer has just completed a four-year tryout of this plan in training the employees of a public utility which carries approximately 10,000 people on its payroll. The purpose of this paper is to show how a similar comprehensive training program, utilizing supervisors as teachers, may be installed in any public utility, publicly or privately owned, and to indicate the results that may be attained by such a training program.

Supervisor's Responsibility

Most public utilities have, in the past twenty years, given their foremen and department heads some type of supervisory training. It is customary, in all such foremanship courses, to devote a part of the time to a discussion of the supervisor's responsibility for training and developing his subordinates. When the supervisory force has thus been made aware of its responsibility for teaching, it is not difficult to win the co-operation of these men and women toward a training program in which they take care of all instruction. The plea that these key employees are too busy to devote a few hours monthly to this task is heard only when the supervisors are improperly approached at the beginning. Under ordinary circumstances any supervisor prefers to teach his own employees rather than have an "outsider" perform this function.

The first job facing the training or personnel supervisor is that of making good conference leaders out of the supervisors. Since the best way to learn how to lead conferences is to do just that, much of this instruction takes place after the training program is actually under way.

Preliminary Meeting

It is well to begin the training in a single division employing perhaps twenty or thirty supervisors, and later expand the program to such other departments as management desires. In a preliminary meeting with the supervisors of this initial division the training supervisor outlines the program to them and leads a demonstration conference of the general type which these men and women will be expected to conduct with their own subordinates. In this discussion, which must be interesting, the supervisors attending act as the conference group. It is important that the majority of the supervisors leave this preliminary meeting in a proper frame of mind to co-operate in the promotion of the training program.

At the second meeting with the supervisors, which is the first "rehearsal" meeting of the program, the training supervisor leads the identical conference which these men and women will individually lead with their subordinates during the ensuing month. The supervisors act as a discussion group, while at the same time they are critically studying the technique of the leader in directing the discussion. This dual function sounds difficult of accomplishment, but actually it is not.

Conference Plans

The opening conference of the series is made as simple as possible. The supervisor has but to employ one or two discussion questions which are sure-fire in any employee group. Also, at the close of the first rehearsal meeting, each supervisor is furnished with a copy of a conference plan which is a complete guide to his conduct of this opening conference with his subordinates. Similar conference plans are issued at each succeeding rehearsal meeting.

Employee meetings are held on company time, employee time, or half-and-half, at the discretion of management. When practicable, they are held on company time. Each supervisor leads one or more conferences with his subordinates, dividing them into groups of twenty or less. The training supervisor visits, as a silent but critical spectator, as many of these meetings as possible, and later discusses privately with the

[*Continued on page 124*]

Mercury Vapor Extends Life of Steam Sites

Superposition of mercury vapor on steam cycle promises higher plant capacities and efficiencies — Operating performance and test records indicate the potentiality of this development

A. R. SMITH and E. S. THOMPSON, Turbine Engineering Department, General Electric Company*

ALL THE mercury-vapor boiler and turbine equipments installed so far have been "topping units." This is the field for the widest application of the process, as any steam plant, no matter what its operating temperature and pressure, can be given a new lease on economic life if mercury equipment is added.

With mercury superposed over 600 lb. gage and 730 F. steam, 7,250 kw. may be generated per 100,000 lb. per hour of steam produced in the condenser boiler, whereas a superposed steam turbine at 1,200 psi. gage and 925 F. can generate 1,960 kw. per 100,000 lb. per hour steam flow. Even when such a steam turbine is superposed over low-pressure turbines operating at 350 psi. gage and 635 F., the power generated by the high pressure is only 3,330 kw. per 100,000 lb. per hour steam flow. Looking into the future, mercury might be superposed on modern 1,200 psi. gage and 925 F. steam, and in this case 5,650 kw. would still be generated per 100,000 lb. per hour of 1,200 psi. gage steam. This illustrates the large amount of by-product power which can be produced by superposing the mercury cycle over a fixed amount of steam flow.

As time goes on there will, no doubt, be applications for superposition over higher existing steam pressures and superposing still greater capacities over moderate steam pressures.

Steam is the best medium available for use as the lower-temperature fluid in a binary cycle. Certain other fluids, such as ammonia, methyl chloride, ethyl chloride, sodium dioxide and ethyl bromide, have been investigated, but no commercial success has yet been obtained.

All known fluids for use as the top fluid in the binary cycle have been investigated and, with the exception of mercury, have been found lacking in some of the fundamental requirements.

The market for mercury, as with other metals or commodities which have strategical value, is now affected by war conditions. However, studies indicate that in normal times all the mercury necessary will be available for power production without dislocating the market.

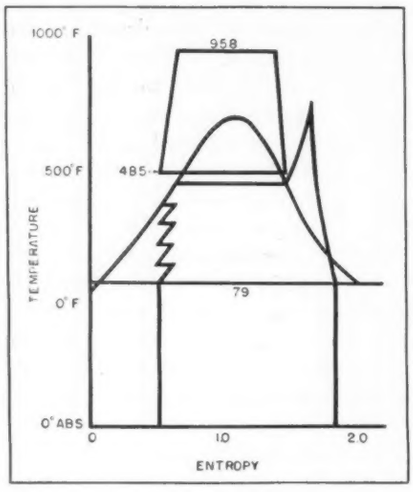
Successive Plants

Two plants were built in 1932, one for the Schenectady works of the General Electric Company and the other for the Kearny station of the Public Service Electric & Gas Company of New Jersey. The capacity of these plants was double that of the earlier built Hartford plant* and the mercury-boiler pressure and temperature were increased to 140 psi. gage and 975 F.

Schenectady Plant

Difference in the Schenectady plant from all previous plants is that the turbine generator and condenser boil-

* Excerpts adapted from paper presented at A.S.M.E. Metropolitan Section, New York, March 19, 1940.



Temperature-entropy diagram of mercury-vapor cycle

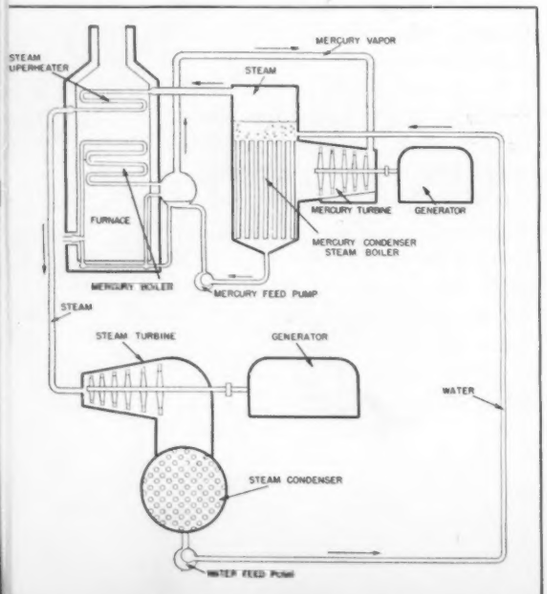
Mercury, 125 psi. gage; 958 F.; 3 in. back pressure.

Steam, 400 lb. gage; 750 F.; 1 in. back pressure.

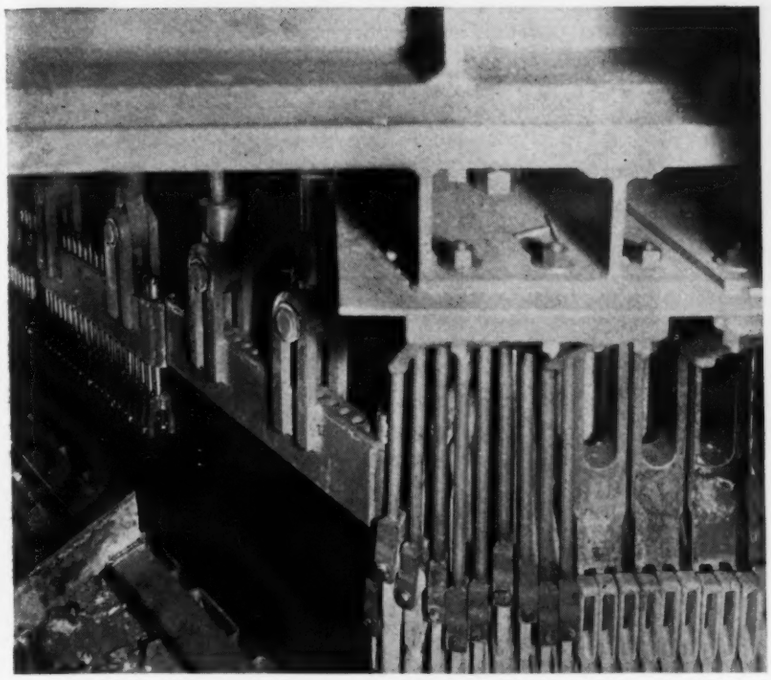
Over-all heat rate, 8,960 B.t.u. per kw.-hr.
Turbine heat rate, 7,365 B.t.u. per kw.-hr.
Boiler, 85 per cent; mercury turbine, 72.5 per cent; steam turbine, 80 per cent.

Feed pump, 0.5 per cent; auxiliaries, 2.9 per cent.

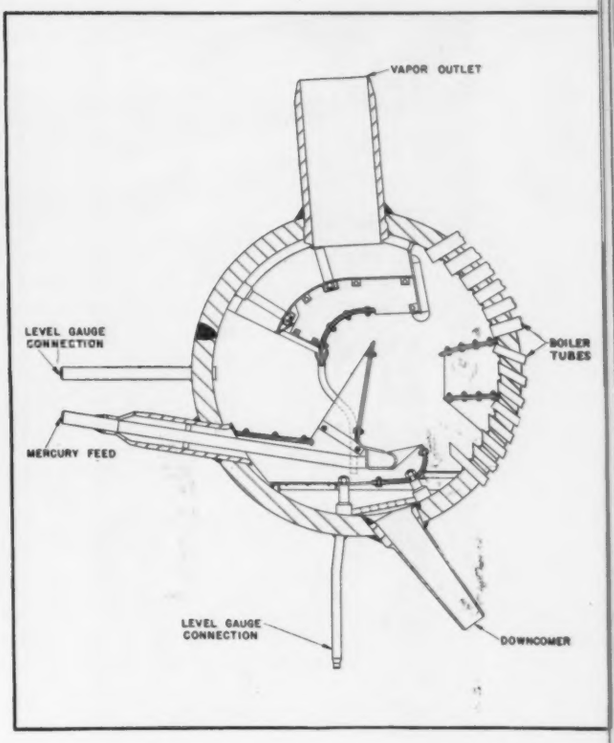
Mercury-vapor-steam-electric generating system



* See "Electrical World," July 5, 1930, page 35.



Furnace-wall tube suspension at arch, Kearny mercury boiler



Section through Kearny mercury-boiler drum shows baffling to assure dry vapor

ers are not placed above the boiler. Condensed mercury liquid is returned to the boiler by means of a centrifugal pump. This pump requires only 8 hp. per 1,000 kw. of mercury-turbine capacity. It is an outdoor station and has passed through several severe winters without any operating difficulties.

Kearny Unit

The original mercury plant installed in the Kearny generating station was first operated in March, 1933. The boiler, turbine generator and condenser boilers were duplicates of those at Schenectady, but the mercury-boiler feed is returned by the gravity system as at Hartford. Floor-space limitation was a major factor in this decision.

The first boiler was operated until September, 1938, when it was removed to make way for a new one of advanced design.

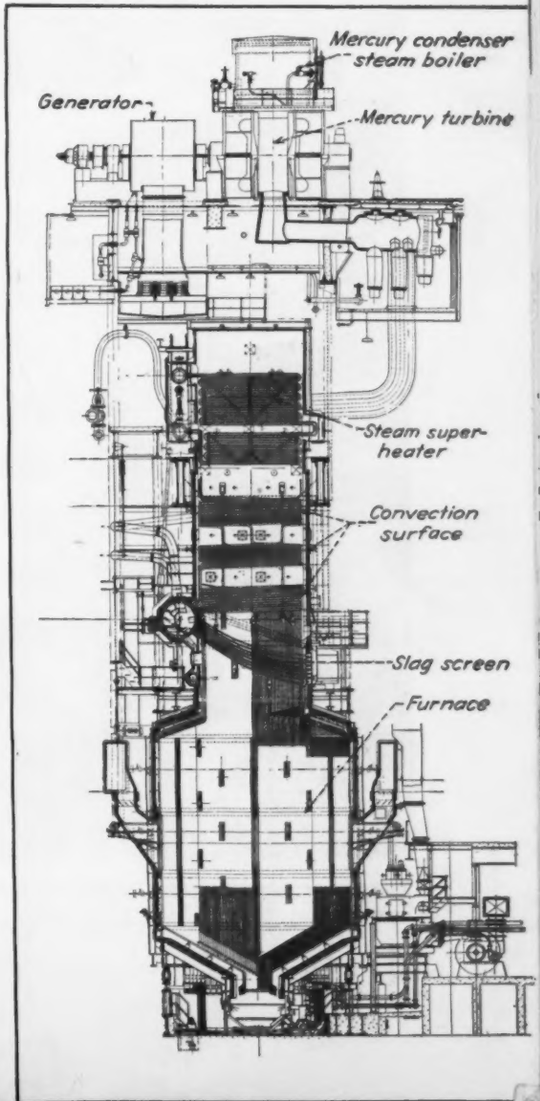
The new mercury boiler at the Kearny station of the Public Service Electric & Gas Company of New Jersey began operation on May 5, 1940. It produces 20,000 kw. from the mercury turbine generator and 300,000 lb. per hour of steam at 365 psi. gage and 750 F.

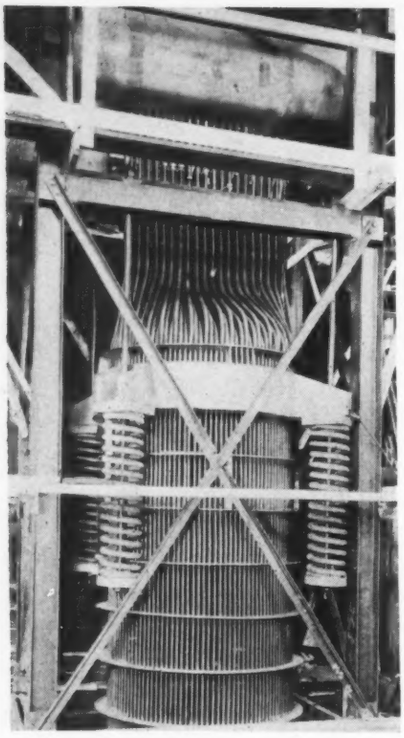
The new boiler furnace is of octagonal shape in plan, for the purpose of conserving mercury and better equalizing the heat absorbed by all the furnace tubes. The burners are so constructed that either coal or oil may be used.

Furnace walls are completely covered with mercury tubes. At the beginning of the arch at the top of the vertical run the tubes are supported by hangers so they hang vertically and, in turn, partially support the bottom, which is formed as a unit with a structural-steel frame. Large coil springs on the under side aid in supporting the bottom. In order that no single tube may be overstressed by this hanging load, they are attached through small springs to the structural bottom, which allows for a reasonably individual motion consistent with possible temperature differences between tubes.

Porcupine tubes used for many years in mercury boilers were ingenious in design and functioned quite well, but the small passages were a potential source of plugging by foreign material and they were hard to clean and expensive to manufacture, so they were not used in the new boiler. By substituting wall tubes for the former porcupine tube surface it became possible to remove the complication of seven drums, which involved equalizing difficulties and other disadvantageous features. The new boiler has a single drum of 54 in. ID with 4½-in. thick walls, 30 ft. long, weighing 90,000 lb. A section through the drum shows the arrange-

Mercury Installation at Kearny station of public Service Electric & Gas Company





Pittsfield mercury test boiler tube assembly

Table I—Major Characteristics of Mercury-Steam Plants in Operation

Plant	Year	Mercury Turbine, Kw.	Mercury Boiler		Steam Production	
			Pressure Lb. Gage	Total Temp. Deg. F.	Lb. per hour*	Press Lb. Gage
Hartford Elec. Lt. Co., South Meadow Station...	1928	10,000	85	908	130,000	375
Pub. Serv. Elec. & Gas Co. of New Jersey, Kearny Station	1940	20,000	140	975	300,000	365
General Electric Co., Schenectady	1932	20,000	140	975	325,000	450

* Approximate only, varies with feed water temperature.

ment of baffles, which are functioning so well that there is no measurable moisture carry-over. In fact, the pressure drop from the drum to the turbine produces about 30 F. superheat in the vapor.

Kearny Operation

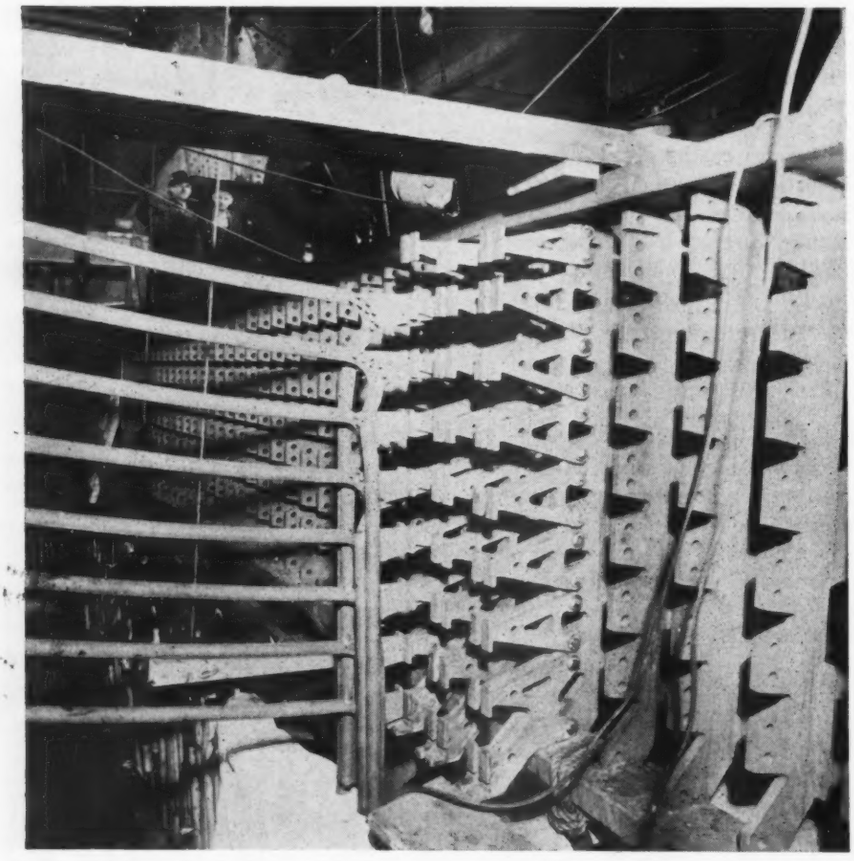
The Kearny boiler contains 392,000 lb. of mercury. The heat developed suffices for the generation of 20,000 kw. in the mercury turbine and 30,000 kw. from the steam generated in the condenser boiler. Since auxiliary equipment requires 1,200 kw., the total mercury in the boiler amounts to 8.0 lb. per net kilowatt.

Convection surface is empty when cold, but in service is filled with a mixture of liquid and vapor, mostly vapor. It is believed that an extension of this principle of mixture-filled tubes to the hotter parts of the furnace would materially reduce the amount of mercury needed in future designs so that its cost and obtainability would be less important factors.

Design of this boiler in so far as the functioning of the mercury is concerned was by General Electric Company. The mechanical design, combustion facilities and building and erection were done by the Babcock & Wilcox Company.

Between May 6, 1941, and February 1, 1941, the new plant has produced 103,540,000 kw.-hr. from the mercury turbine generator and 1,505,232,000 lb. of steam. There are approximately five thousand field and factory welds in the boiler and no leaks were found in the hydrostatic test or during operation.

Operation has been excellent and practically all the time at full load. (See load curve.) Firing has been with oil for the most part. Because of the unusual boiler design and the temperatures at which the tubes work, it was thought advisable to try out coal firing to find the nature and location of slag deposits before installing soot blowers.



Slag screen tubes connected to floating support in General Electric mercury boiler at Kearny plant

Kearny Results

During the months of May and June, 1940, tests of the mercury plant at Kearny were conducted by the General Electric Company with the assistance of the Babcock & Wilcox Company and the Public Service Electric & Gas Company of New Jersey. Eight-hour tests at 37½, 50, 62½, 75, 87½ and 100 per cent load were made, allowing at least 48 hours at each load before making the test. A test at 30 per cent load was run for two hours.

The test results are shown in Table IV and the net plant heat rate is shown in an accompanying illustration. The full-load heat rate of 9,175

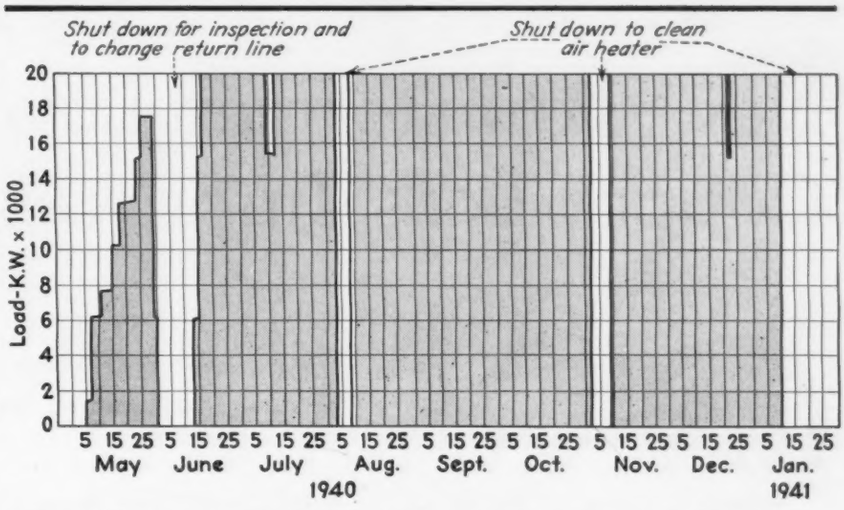
B.t.u. per kilowatt-hour, or 37.19 per cent thermal efficiency, means that a kilowatt-hour is being produced for 0.502 lb. of 18,275 B.t.u. per lb. bunker C fuel oil.

Table II—Thirteen-Year Record of 10,000-Kw. Mercury Plant at South Meadow Station of Hartford Electric Light Company

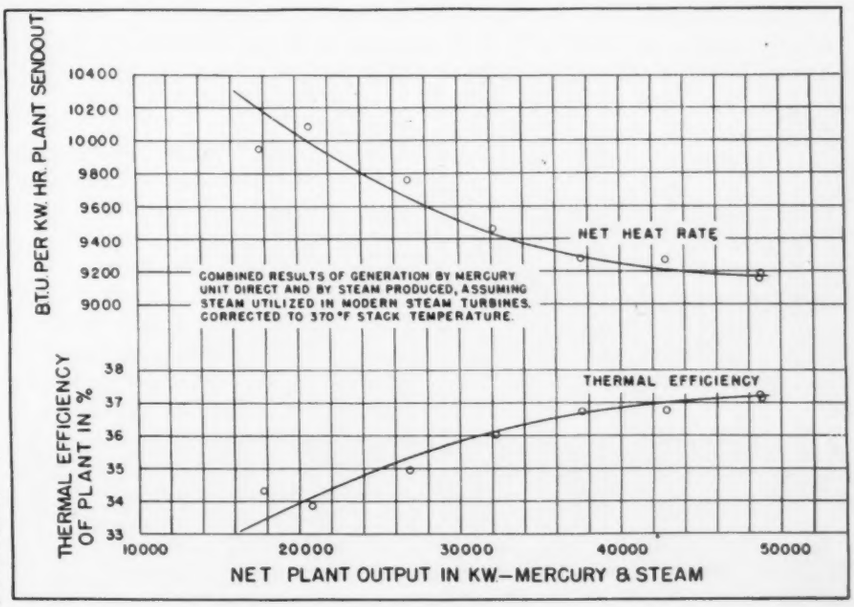
Year	Kw.-Hr. Mercury Only at Approximately 4,000 B.t.u.	Kw.-Hr. Total Mercury and Steam (net)	B.t.u. per Kw.-Hr.	Hours Run
1928	2,900,000	5,700,000	.....	429
1929	5,600,000	11,700,000	11,200	993
1930	52,500,000	121,000,000	10,300	6,157
1931	5,400,000	12,700,000	11,300	651
1932	49,400,000	110,000,000	10,600	6,516
1933	43,000,000	102,000,000	10,500	6,753
1934	51,773,000	124,283,533	10,889	7,596
1935	49,190,000	122,096,850	10,250	7,212
1936	52,725,000	129,261,710	10,210	7,309
1937	49,979,000	125,737,275	10,120	7,729
1938	47,646,000	123,023,058	10,000	7,684
1939	50,240,000	121,122,000	10,000	8,140
(1940 to 9-25-40)	27,712,000	74,897,000	10,250	5,162
Total	488,065,000	1,193,521,426	.....	72,331

Table III—Eight-Year Record of 20,000-Kw. Mercury Plant at Schenectady

Year	Kw.-Hr. Mercury Turbine Generator	Pounds of Steam Produced	Hours Run
1933	2,537,000	53,317,000	425
1934	52,136,000	1,088,411,000	4,921
1935	31,304,000	687,040,000	3,203
1936	28,248,100	693,597,000	3,671
1937	17,066,800	567,209,000	3,375
1938	36,752,100	1,136,689,000	7,225
1939	47,345,200	1,169,399,000	6,384
(1940 to 9-1-40)	36,464,900	870,830,000	4,555
Total	251,854,100	6,266,492,000	33,759



General Electric mercury turbine operated practically continuously at Kearny plant



Performance test of Kearny mercury-steam plant

Table IV—Tests on Kearny Unit Show 9,175 B.t.u. per Kilowatt-Hour Heat Rate

Test No.	1	2	3	4	5	6	7	8
Date, 1940	5-9	5-11	5-16	5-20	5-23	5-27	6-17	6-18
Mercury turbine-generator output, kw	6,250	7,763	10,188	12,712	15,333	17,683	20,213	20,175
Steam flow, 1,000 lb. per hour	125.7	140.9	178.4	211.7	239.9	271.9	306.6	306.7
Steam pressure, lb. per sq.in. gage	351.6	355.6	355.4	256.6	356.8	359.7	358.1	359.4
Steam temperature, F	666	689	708	682	700	688	711	706
Feedwater temperature, F	375	306.7	375.3	374.2	370.7	367	374	374
Equivalent steam turbine output, kw	11,863	13,497	17,290	20,223	23,141	26,185	29,790	29,713
Total gross output, kw	18,113	21,260	27,478	32,935	38,474	43,868	50,003	49,888
Auxiliary power (calc.), kw	396	466	610	743	887	1,034	1,212	1,208
Total net output, kw	17,717	20,794	26,868	32,192	37,587	42,834	48,791	48,680
Fuel oil, lb. per hour	9,481	11,464	14,346	16,672	19,029	21,760	24,626	24,518
Stack temperature, F	310	368	369	370	358	373	382	374
Calorific value of fuel (as fired), B.t.u. per lb.	18,276	18,276	18,276	18,276	18,272	18,272	18,268	18,202
Net plant heat rate, B.t.u. per kw-hr	9,780	10,076	9,758	9,465	9,250	9,282	9,220	9,168
Net plant heat rate corrected to 370 F. stack temperature, B.t.u. per kw.-hr	9,948	10,082	9,761	9,465	9,282	9,274	9,189	9,158

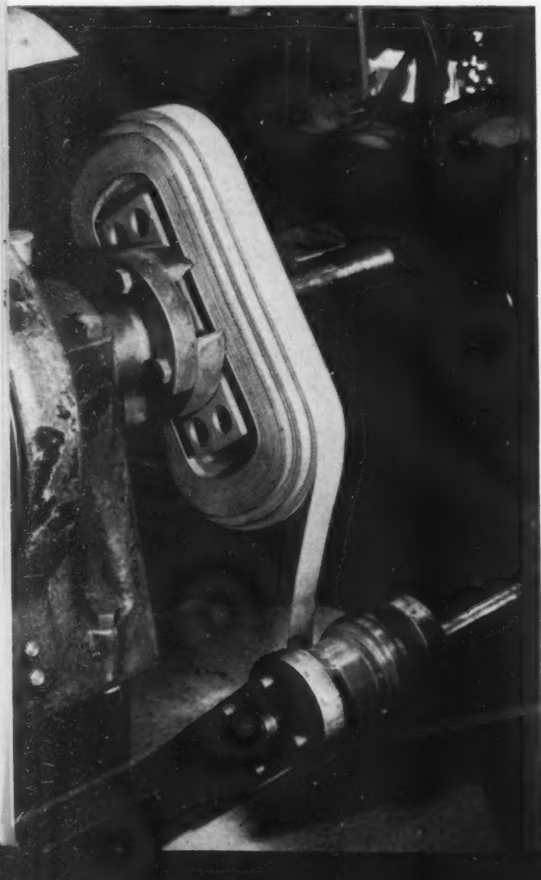
New Transformer Lowers Copper Loss, Improves Regulation

New wound-core design brings lower copper loss without excessive exciting current — Round coils, with low resistance and reactance, offer improved regulation over conventional designs

J. O. FENWICK and D. E. WIEGAND, Line Material Company, Zanesville, Ohio

UNDER current distribution practice, transformers are being loaded more hours of a 24-hour day than ever before. The higher load factors resulting from this practice justify serious analysis of transformers and transformer losses. Such studies as have been made indicate the desirability of reducing transformer copper losses, even at the expense of slightly higher core loss, since by this change in the ratio of transformer losses the cost of losses would be reduced. They also show that the reduction in voltage drop, resulting from lower copper loss, is desirable under present load condition, in the interest of delivering more uniform voltage to the customer.

IN MAKING transformer core, electrical steel strip, welded end to end, is wound in continuous coil form on a single winding lathe into a core of cruciform section



But to lower transformer copper loss without increasing cost means increased transformer core loss and in any given transformer design higher exciting current. Because to reduce copper loss and maintain prevailing cost levels the transformer designer must in effect remove turns from the present design. Removing turns increases flux in the core and forces it to operate at higher flux density. Increased flux density results in higher core losses and higher exciting current. Furthermore, air gaps in the magnetic circuit of conventional laminated core transformers are a major contributing factor in the total exciting current of the core. This higher current has in the past been an obstacle in the path of any substantial change in the ratio of transformer losses.

A new transformer, however, made by winding a core in continuous coil form and winding round coils on the completed core, now permits a considerable change in the ratio of transformer losses to be realized without producing excessive exciting current. The round solenoid type coils with low resistance and reactance, resulting from this design, give better regulation at all power factors and also high short circuit capacity.

The magnitude of peak loads and their duration on modern distribution systems has increased the significance of transformer regulation and made better regulation highly desirable.

Transformer voltage drop is dependent on the resistance and reactance of the transformer winding. Lower resistance and lower reactance are both required to get a substantial improvement in transformer voltage regulation. But while lower copper loss reduces the resistance component of the voltage drop, the reactance component must also be reduced.

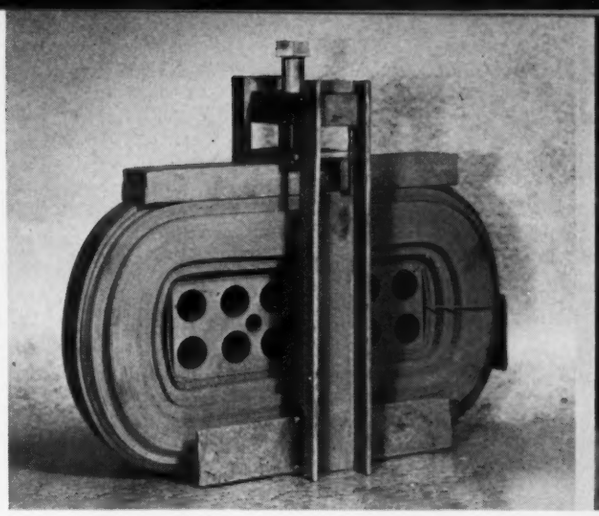
With conventional transformer design, using a laminated core and rectangular coil section, the reactance component cannot be lowered any appreciable amount without increasing cost. Reactance depends to a great extent on the shape of the transformer coil, ratio of length to thickness and the amount of bulge between coils and layers.

In transformer design, therefore, use of a compact circular coil with a large ratio of length to thickness will generally result in low reactance. This, with a corresponding reduction in copper loss, will result in satisfactory regulation at all power factors.

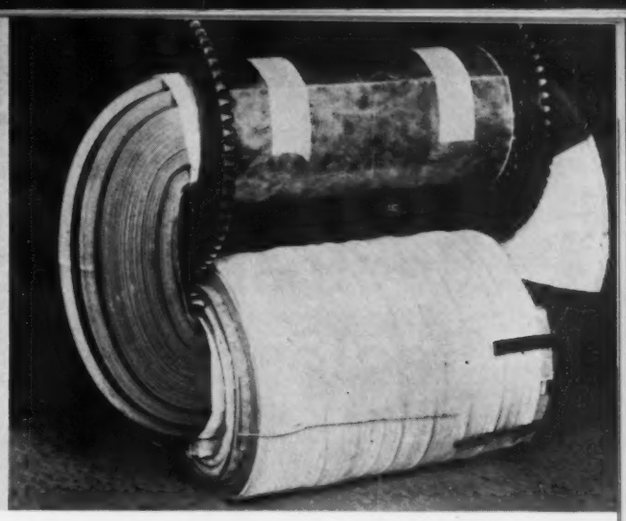
Overload Capacity

Heavy loading of transformers on the peaks (it is now quite common to operate transformers up to 150 per cent load for peaks of three to four hours) represents a somewhat new requirement for distribution transformers in general, as regards short time overload capacity.

All transformers have inherent short time overload capacity, but to improve this characteristic in any



THE CORE, clamped to reduce winding bulge, is annealed to relieve inherent strains on corners where strip has been bent. After annealing the steel in the core has the same magnetic characteristics that it had previous to winding



WITH THE CORE undisturbed after annealing, coil form flanges are installed on the leg and insulating paper wound on the flanges to make a paper tube winding form which is part of the coil

given design usually means increased cost.

However, in any new design in which high overload capacity is sought it is desirable to reduce to a minimum the surface of the coil enveloped by the iron circuit and increase the coil surface exposed to free oil and, thus, with other factors equal, secure a better cooling characteristic. A long solenoid-type coil approaches these objectives.

Impulse Strength

With increasing emphasis on reduction of lightning outages on distribution circuits transformer impulse strength has become a factor of increased importance, in an attempt to hold down maintenance costs. Since the advent of the cathode-ray oscillograph and the surge generator considerable improvement has been made in transformer impulse strength, but further improvement with conventional design is apt to prove expensive.

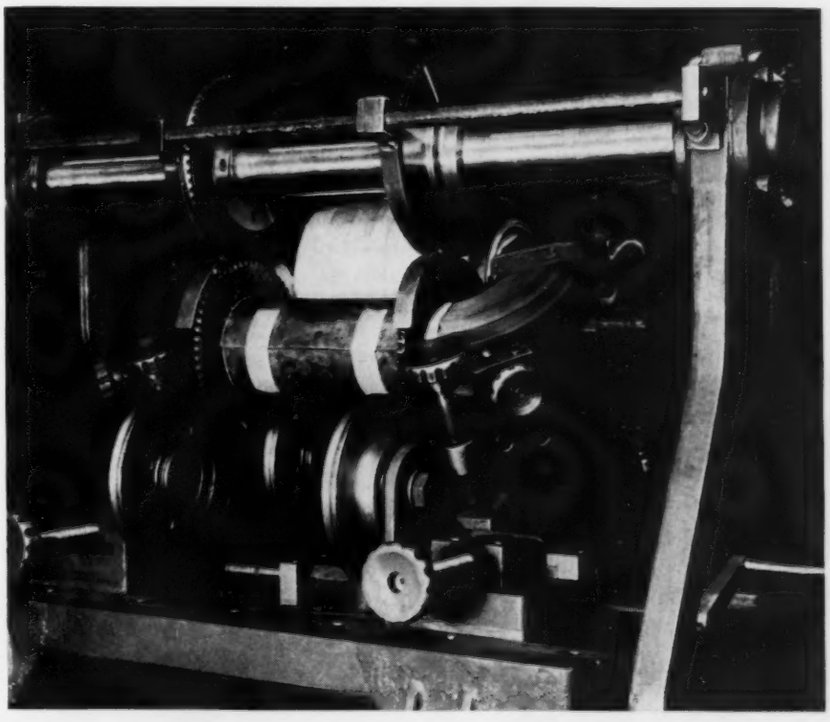
One undesirable characteristic of transformer impulse strength has been the variation in impulse strength from unit to unit for a given design. In conventional rectangular-oil transformer design this variation may arise from mechanical damage to conductor insulation during the winding operation due to the necessity for bending and forming the wire into a rectangular-shaped coil. Handling necessary in assembling conventional transformers is another potential source of damage to windings, leading to variations in impulse strength.

One of the important factors in lowering the cost of transformers over the past period of years has been the improvement in the electrical steel for transformer cores. In reducing core loss of steel used in transformers the core steel manufacturers found it necessary to increase the silicon content of core steel. Addition of silicon tends to reduce permeability rather than improve permeability. Therefore, although there was a reduction in core loss in transformer core steel of about 25 per cent from 1930 to 1940, there has not been a corresponding improvement in permeability.

Paralleling improvements in the core loss of core steel, transformers have been redesigned to take advantage of new low core loss steel, in order to reduce cost. Today the designer finds it very difficult to take advantage of the best grade of core steel available due to the exciting current limitation previously mentioned. Therefore, we are in need of a transformer construction that will

[*Continued on page 128*]

COMPLETED core and coil assembly



CLAMPED in a winding machine, form flanges are centered between drive and idler rollers and the core adjusted to permit free rotation of power flanges around the core leg

Reclosing Breakers or Reclosing Fuses—Which?

Criteria for choice hinge upon relative reliability, circuit capacity, load importance, territorial accessibility, opportunity for co-ordination and relative cost

H. A. P. LANGSTAFF, West Penn Power Company*

MODERN SYSTEMS of power distribution require restoration of service equipment to cope with and to counteract the ever-impending interruption of service caused by lightning discharge, speeding vehicles, wire-bearing kites, branches of trees and other interference sources. In a very high proportion of cases the interfering medium is effective through a relatively brief period of time. The conductors having been de-energized to check the flow of destructive over-currents are promptly ready to be again energized for the restoration of constructive currents.

The speed with which that restoration of energy is accomplished is commonly a variable because of tangible and intangible factors which affect the choice of equipment installed for the control of the circuit in question. As the use of electric energy takes increasingly greater part in the operation of the domestic household from the water heater in the basement to the ventilating fan in the attic any unnecessary extension in the duration of a power interruption becomes less and less to be tolerated.

Manual vs. Automatic

Breakers controlling a distribution load may be closed manually in one station, whereas those in another station with identical type of load might well be automatically reclosed. The former station possibly requires an attendant because of other equipment in the station or because of general system operating duties. The automatic station will usually have more prompt reclosing or at least reclosing more uniformly speedy and dependable. Rapid restoration is quite desirable. Why not, therefore, install automatic reclosing devices in the attended station? A study of the operating record of the distribution line will usually provide the answer. On some systems the breakers do not trip often enough (possibly only once a year) to warrant expenditure for automatic devices and the service is satisfactory without automatic functioning.

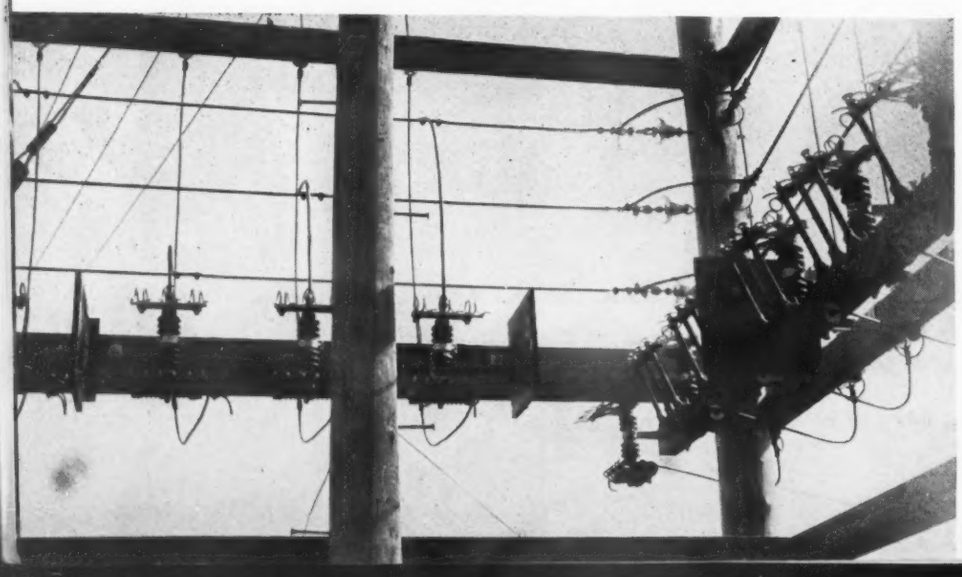
Since distribution feeders trip in general very infrequently, it is inviting to consider the installation of fuses instead of oil circuit breakers. A single-operation fuse would evidently not be suitable for an important or settled community service. Re-fusing takes too long and there are many other operating objections in the general case. A dependable reclosing fuse assembly with one or two reclosures subsequent to the initial fuse blowing presents interesting possibilities. It is far less costly than is a fully relayed reclosing breaker. Its general space requirements are less.

Time for Re-Fusing

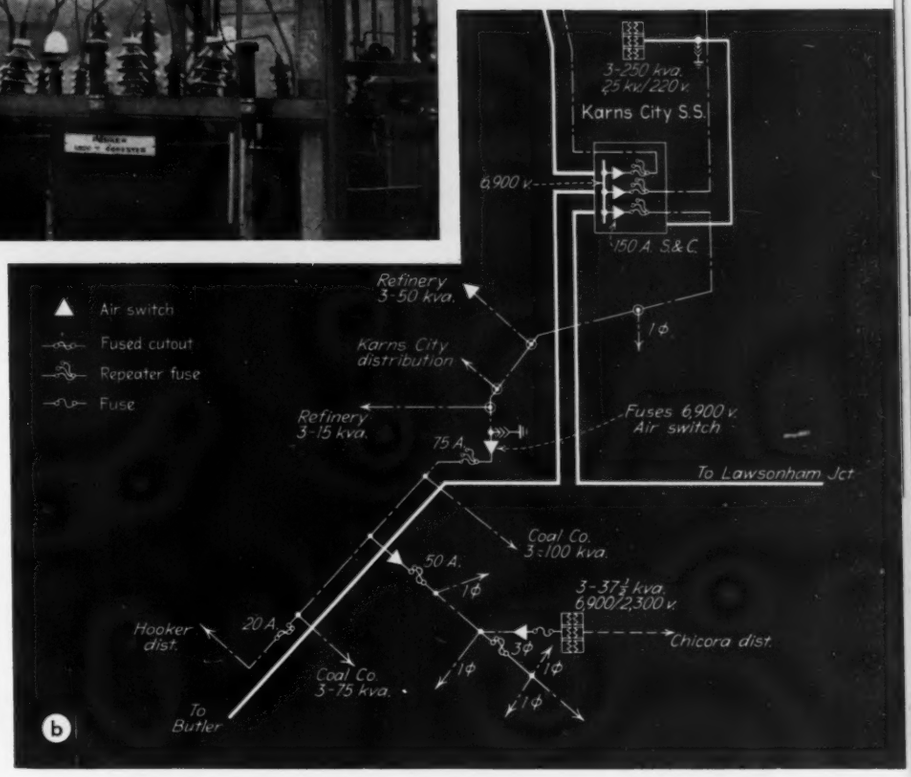
The statement has just been made, "Re-fusing takes too long." At an attended substation probably ten minutes would elapse from the time that the fuse blew until the operator installed a new fuse and that lapse of time is estimated from the time that the operator learned that the fuse has blown. That is too long. If the blown fuse is at a non-attended station the re-fusing time might be anywhere from ten minutes to five or six times that long, depending upon how

* Electrical engineer.

MILLHEIM SUBSTATION proved advantageous application of repeater fuses of drop-out type



LIQUID-FILLED repeating fuses control three three-phase circuits at Karns City substation (a) serving heavily loaded branch circuits. The lower circuit leaves the substation through 150-amp. repeater fuses and, to care for a long rural extension, another set (75-amp.) is installed several miles away



soon the district operator is given notice of the blown fuse and upon the availability of a service man, upon the communication facilities, upon the weather and upon any number of such prevailing conditions.

Relative Costs

There is considerable difference in cost of a fully automatic breaker of 15,000-volt rating and 50,000-kva. interrupting capacity and the cost of a 15,000-volt rated reclosing fuse of the three-shot variety. On the average the breaker could be obtained and installed for about $2,500 complete with disconnects and by-pass switch. The repeater fuse cost would approximate $325. Furthermore, the fuse takes far less space than does the oil circuit breaker. As evidence of this, refer to an accompanying illustration which shows a substation having repeater fuses of the dropout type providing control for two single-phase circuits and three three-phase circuits; another picture shows liquid-filled repeating fuses installed at a substation for the control of three three-phase circuits. Another installation comprises a complete outdoor substation equipped with an automatic reclosing circuit breaker applied in this case due to heavy load currents and comparatively heavily loaded branch circuits to rural service areas.

Fuse Reclosure

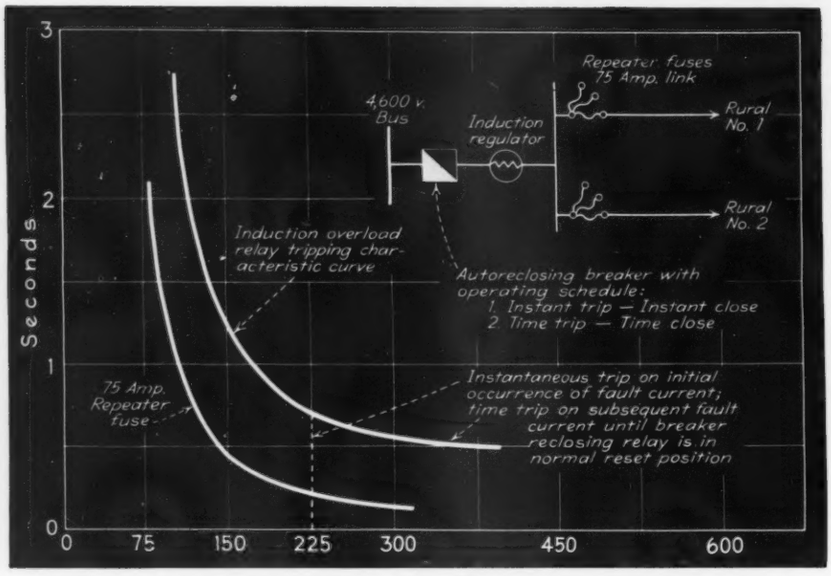
The present-day reclosing fuse has certain limitations. First, reliability must be considered. Present fuses can be depended upon to blow initially, and their certainty of reclosure is being improved by the manufacturers working toward the end that they can be made as dependable as the reclosing breaker. Mechanical details of fuses which appear on thorough examination to be inherently sound may, however, fail to give results after weathering for long periods of time prior to being called into action. The inability of the investigator to find out the reason for the failure is annoying. The lineman who restores service can take no time to make a careful examination. The fuse upon subsequent test will probably work in excellent fashion.

Troubles that have been experienced with repeater fuses have arisen principally from difficulties due to friction. Certain time-delay repeater fuses have failed to perform due to friction caused by insufficient mechanical clearance. The obvious remedy has been to use fuses having slightly less time delay. Fuses without time delay have failed because of the corrosion of small parts in an industrial atmosphere conducive to such action. Non-corrodible parts throughout have been the solution. Fuses having all those improvements and located where atmospheric abnormalities have not existed still have at times failed to operate. We have had repeater fuses operate successfully and then the very next day fail entirely to operate.

We must conclude at this stage that the breaker is somewhat more reliable than the fuse as a service-restoration device.

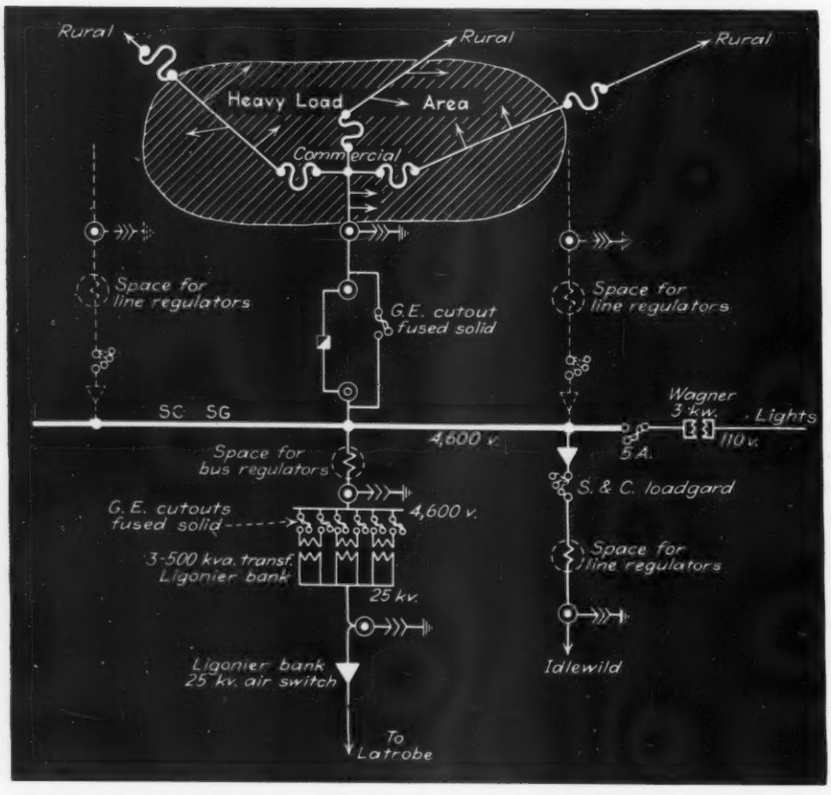
Operating Comparison

Secondly, let us compare the fuse and breaker from an operating standpoint. The breaker can, without maintenance, be repeatedly opened and closed during day-long storming conditions. The repeater fuse requires link replacement service after each operation. For branch lines of long length through rural districts the repeater fuse generally is productive of satisfaction. It is a great improvement over the single fuse branch-line application. Not so applicable is it



BREAKER trips ahead of fuse blowing on initial occurrence of trouble, but has longer time setting for subsequent trips. Breaker thus remains closed while repeater fuse serving the faulted branch goes through its sequence of operations

as a base-line protection device for a long trunk feeder from which there extend numerous branches. But there again if short circuit values and branch loads permit co-ordination of fuse sizes fully satisfactory results can be obtained. (Refer to the accompanying illustration showing 6,900-volt lines around Karns City substation.)



BREAKER warranted from standpoints of current-carrying requirements and necessary relay co-ordination with branch fuses

Note A—Automatic Switch Company's type L-15, 400-amp., 15-kv. breaker trips instantaneously on first occurrence of trouble and trips on time delay during reclosing cycle.

Note B—Unit composed of two Loadgard type fuses and one Semafor dropout renewable-link type fuse

During 1939 operating records show about eighteen cases of trouble in which repeater fuses were called upon to operate. In twelve cases, or 67 percent, the circuit was successfully re-energized by the reclosing of fuses. In five cases all fuses blew in the faulted phase and in one case the fuse unit failed to reclose. Fifty-eight distribution circuits or branches were supervised by repeater fuses in the year 1939, the circuits being both single phase and three phase in character. It is interesting to note that during that same year 130 distribution circuits were supervised by automatic reclosing breakers, and during that year there were 184 cases of line trouble. The breakers reclosed and re-energized the line successfully in 141 cases. This corresponds to 77 percent successful reclosure. In 39 cases, or 21 percent, the breaker locked out and in four cases, or 2 percent, there was a failure of the breaker to operate. Complete figures are not available for the year 1940, but preliminary statistics indicate that there were eighteen repeater fuse operations. In four cases, or 22 percent, service was restored by reclosing fuse action; in twelve cases, or 67 percent, all fuses were blown; in two cases, or 11 percent, the reclosing fuse failed to operate as it was expected to do.

Repeater Fuses

Where several feeders are equipped at a substation with repeater fuses the installation of a non-reclosing automatic breaker could be used with connections to any one of the feeders provided by means of a transfer bus. This arrangement would permit repeated manual testing of a faulted line. It would also permit restoration of service to the faulted feeder quickly, while blown links of the repeater fuse are being replaced.

Installations have been made wherein two circuits, each equipped with repeater fuses, branch from the terminals of an automatic reclosing breaker. During the past year excellent results have been obtained with that type of installation on the West Penn System.

High Ampere Loads

A third point of consideration with respect to the choice between reclosing fuses and reclosing breakers is one

that at present inherently favors the selection of a breaker. That factor is the ampere load of the circuit. Where load or circuit fusing co-ordination would require the use at the substation of a fuse in excess of 150 amp. a breaker is invariably selected for the job. Furthermore, the proximity of heavily fused load may be such that a relayed breaker is necessary for proper fault current co-ordination and operational selectivity.

Criteria for Choice

In general, the question of breaker versus reclosing fuse application cannot be decided by any fixed set of rules, nor by consideration of economics alone. Every application warrants a thorough analysis of cost and of service requirements before a decision can be rendered as to whether the breaker or the repeater fuse is applicable. Cases may occur where initially a repeater fuse is selected with the definite plan that at a later date, when load growth warrants, it shall be superseded or replaced by a breaker.

The accompanying drawing for Ligonier substation is representative of a substation distributing at 4,600 volts to a commercial, residential and recreation district over two three-phase circuits. One circuit, which feeds rural distribution and a recreation center, is relatively lightly loaded, and repeater fuses were installed. They have given very satisfactory operating results.

Breaker Warranted

The other circuit, however, feeds the town of Ligonier, where there is a heavy concentrated load with comparatively heavy branch circuits. A breaker was warranted from the standpoints of current-carrying requirements and necessary relay co-ordination with branch fuses. Beyond the fringe of the heavily loaded business district circuits extend into the rural district surrounding the town. The relay sequence described in the illustration has proved very successful at this location and elsewhere, in that it permits transient faults to be released from the system without the blowing of the heavily fused branches. The reclosing cycle is so speedy that the momentary interruption to the entire circuit causes no disturbance to normal service.

Loop Helps to Serve Growing Load

Heavy feeder across loop-inclosed area is cut at the center when substation at far side is connected to loop

E. B. HORNBAKER,* Southern Colorado Power Company, Pueblo

RECENT revisions in the distribution system at Pueblo, served by Southern Colorado Power Company, exemplify a method of handling the problem of increasing consumption per residential meter.

After considering several possible solutions, we decided that the best one would be to extend 13.8 kv. to several sections of Pueblo, to install 13.8/2.3-kv. substations and eventually to complete a 19-mile, 13.8-kv. loop around the town, feeding from two points. This loop has now been completed with the exception of one 3.4-mile tie, which we expect to finish in 1941, linking two substations called South Side and City Park.

As practically all our residential sections were fed from single-phase, 2.3-kv. circuits in alleys, we installed our substations where we could run one heavy three-phase circuit across town. This permitted us to tap the single-phase circuits where the three-phase circuit crossed the alleys, first phasing out with the power plant, so that we did not have power off at any time while making the cut-over.

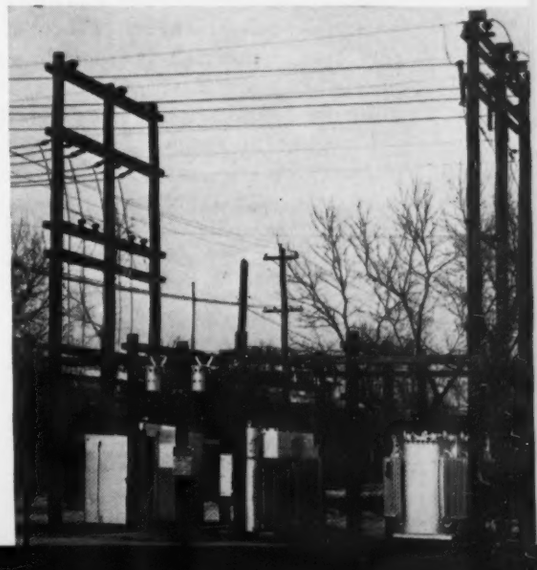
Then it was very simple to cut this three-phase feeder at a predetermined point between the new substation and power plant, thus dividing the load between the power house and the new substation. All substations were so constructed that their capacity could be increased by increasing the size of the transformer, without any other work.

We also provided room for regulators and automatic reclosing switches. Automatic reclosing switches have been added to all the substations except one, and we expect to install one there this year.

We made the secondary distribution on the City Park substation 4-kv. star, common-return, at the time of installation, because of the large area it covered. At the time these substations were installed they had a combined transformer capacity of 1,215 kva. Present combined capacity is 4,500 kva., South Side having a capacity of 1,500 kva., the other three 1,000 kva. each.

In 1940 we increased South Side substation from 1,000 to 1,500 kva., installed regulators and changed the circuits from 2,300 volts delta to 4,000 volts, four-wire star, using a common return. Biggest problem was to effect the cutover without appreciable interruption. We did not receive half a dozen complaints during the entire job.

SOUTH SIDE SUBSTATION after installation of regulators and change to 4,000 volts star
One circuit feeds business section, adjoining steel works, and surrounding territory, tieing into City Park circuit through set of disconnects, normally open. Other circuit takes city and adjoining territory south



* Line superintendent.

Commercial Cooking Program Yields $50,000 E.A.R.

Vigorous selling, sustained promotion and 24-hour service stressed by Buffalo Niagara & Eastern Power as responsible for the addition of 18,000 kw. of new commercial load

G. F. WATTERS, Buffalo Niagara & Eastern Power Corporation, Buffalo, N. Y.

INTENSIVE, individual promotion, combined with a service tie-up guaranteeing prompt, efficient service to all restaurateurs 24 hours a day, seven days a week, plus service of one full-time promotional supervisor, has been responsible for the addition of 3,374 kw. to the commercial load of Western Division Companies of the Niagara Hudson System during 1940. It is interesting to note the progressive development in the commercial cooking field during the past nine years, as follows:

	Kw.	E.A.R.
1932	126	$2,000
1933	500	7,000
1934	585	8,000
1935	1,144	15,975
1936	2,211	39,881
1937	3,178	52,192
1938	2,891	44,172
1939	3,379	48,460
1940	3,374	51,432
Totals	17,588	$269,112
Average Revenue per kw. sold		$15.30

Over the past nine years there has been a total of $269,112 added to the revenue of the company, and 17,588 kw. of commercial cooking load has been responsible. In such a record there undoubtedly has been a certain mortality to some of this load. We have endeavored to figure benefits of this load conservatively enough to offset any mortality which might affect the actual revenue derived.

Complete breakdown of commercial cooking sales for 1940 follows:

Food service establishments, 1940	3,000
Kilowatts sold	3,374
Kilowatt-hours	2,706,621
Revenue	$51,431
Average kw.-hr. per kw. sold	802
Revenue per kw. sold	$15.24
Average rate per kw.-hr. (cents)	1.9
Salesmen	
Part time	12
Full time	1

The Buffalo Niagara Electric Corporation, covering the metropolitan areas of Buffalo, Niagara Falls and the Tonawandas, is faced with stiff gas competition ranging from 540 to 900 B.t.u. In the scattered outlying sections of the Niagara, Lockport & Ontario Power Company, which serves the western New York rural areas, there is some artificial gas and some natural gas, ranging in price from 35 cents per thousand cubic feet up. Throughout the entire territory served there are about 3,000 food-serving establishments. Metropolitan areas are fairly well covered by kitchen equipment houses. In such areas the company does not merchandise equipment and in outlying rural areas it merchandises counter, pantry and heavy-duty equipment to commercial and industrial customers. All equipment is sold at list price and small stocks are carried in merchandising areas.

The successful 1940 promotion was based mainly on the use of proved items used in previous years plus some new ones. The sales promotional personnel in the Buffalo Niagara Electric properties was made up of seven all-purpose promotional salesmen. In each of the five Niagara, Lockport & Ontario properties there was one all-purpose promotional man with the added duties of selling commercial cooking equipment. The entire commercial cooking activities were headed by one full-time promotional supervisor.

Special Utility Organ

To keep the story of the benefits of electric cooking equipment before the customer at all times it was found advisable to publish a monthly

THREE-WAY CO-OPERATION—Various manufacturers supply equipment, wholesaler supplies display area and facilities and utility company backs it all up with 24-hour service and continuous promotion

restaurant house organ. The title selected for the publication was direct and self-explanatory—"Long Profits" —Short Orders." In general, the style of the publication was a testimonial success story treatment in which successful restaurant operators and owners of food establishments were the leading characters. Pictures of new electrified kitchens, short-order counter equipment owners, operators, new buildings—in fact, everything pertaining to the restaurateur himself—appeared each month.

Economical Performance

Built around the picture of the successful operator is a story of the development of the restaurant, its advancing success and the enumeration of the installed electric equipment from the enthusiastic owners concerning the equipment itself and its economical performance. Included in the publication are a monthly menu hint and a column entitled "Did you know"—giving obscure but interesting technique and food data. The purpose of the publication is to pass on to the 2,150 operators receiving timely hints on the "do's and don'ts" of the restaurant business which have proved successful both in increasing good will and customer satisfaction.

In addition to this monthly publication, broadsides obtained through the commercial cooking council are distributed several times a year.

Early in the spring a commercial cooking equipment sales contest was held in merchandising districts. The theme of the contest was "Make selling of commercial cooking equipment your hobby." Quotas were set and merit points awarded to the district with the highest percentage of quota. The merits were then exchanged for practical gifts. In order to keep the salesmen plugging and informed of the activities of their fellow-contestants weekly reports were sent out. The contest proved very successful and the desire for prizes aroused action on the part of the salesmen.

Each spring commercial cooking demonstrations, known as "cooking days," are held in each of the company properties. A complete line of equipment is sent from district to district by truck. Personalized invitations are sent to all restaurant operators. These invitations are followed by personal calls by the salesmen from each district. The demonstrations were conducted by a manufacturer whose representative did the cooking and talking—demonstrating the economy, speed and uniformity of electric cookery by preparing short orders to be served to the visitors.

On-Trial Equipment

One of the most productive types of exposure was the demonstration plan where arrangements are made to install equipment for trial in the prospective purchaser's own kitchen or on his short-order counter. The restaurant owner is permitted to operate the equipment for a period of three days, and in nearly all cases actual use of the equipment resulted in sales. Salesmen were instructed to offer conservative estimates of operation, so that the purchaser was always surprised and pleased when actual operating costs were lower than the estimates given.

One of the most important sales leads during the year was the close tie-up between the promotion department and the service department. Since September of 1939 all commercial cooking equipment repair and upkeep have come under the service department. As a result it has been possible to guarantee service on all equipment 24 hours a day, seven days a week. This one move in itself is a selling point to most restaurant operators—a guarantee that service to his customers, even though a major break in the equipment might arise, would be continued within a short period of time.

Contracts with reputable manufacturers having constant sales representation in the area were drawn up in which they agreed to furnish all materials for repairs on equipment "in guarantee." The company furnished the labor for the repairs and billed the manufacturers on an hourly basis on all major repairs. Where it was necessary to remove the equipment from the owner's premises a similar piece of equipment was loaned until reinstallation of the original piece. In this way service could continue uninterrupted.

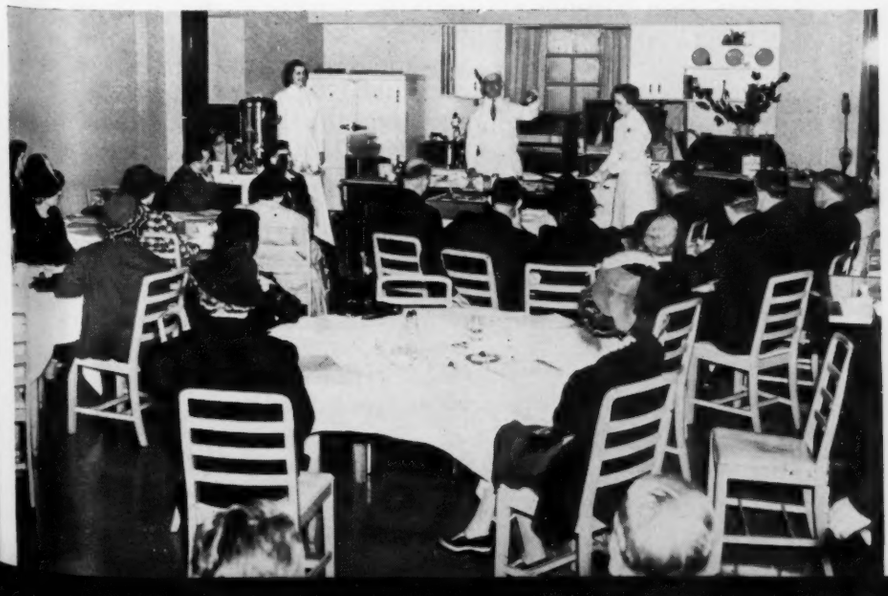
Following a thorough study of the requirements of the restaurant owner

[*Continued on page 130*]

WHAT TO DO
When You Need Service
On Your Electrically Heated
Kitchen Equipment
1. Check the electric fuses to make sure a fuse failure isn't causing the trouble.
2. If the fuses are O.K. and equipment will not operate properly
Call PArkside 3000
3. Please give our telephone operator the following information:
a. Name, exact street address and telephone number of your place of business.
b. State that your call is a "Commercial" call.
c. State what piece of equipment is out of order. Give manufacturer's name. Describe the trouble.
4. A reasonable charge will be made for all repair work, unless equipment fails due to factory defect during period of manufacturer's guarantee.
5. The company does NOT repair motors, motor controls or motorized equipment, nor does it replace glassware. For such service, call the dealer from whom the equipment was purchased.
Parkside 3000 is maintained for your convenience day and night.
BUFFALO NIAGARA ELECTRIC CORPORATION

"CALL PARKSIDE 3000"—a continuous invitation to the customer to avail himself of utility company assistance, a continuous reassurance of utility company parnership. Costs the company money, but keeps the equipment working

PROOF OF THE PUDDING—At demonstration for restaurant owners and managers in utility company building the food is cooked and served. Manufacturer supplies chef, assistants and equipment



Electrical Features of Claytor Hydro Plant—II

Single generator breaker, sectionalized station bus, ultra-high-speed reclosing, provision for the substitution of air breakers (water breakers unpromising) — Extensive differential protection

PHILIP SPORN and H. A. KAMMER,† American Gas & Electric Service Corporation, New York*

TO PROVIDE maximum flexibility with a minimum expediture, so far as investment and operating costs were concerned, the generating capacity of the Claytor plant was connected to the transmission system of the Appalachian Electric Power Company as shown in an accompanying one-line diagram.

* Vice-president and chief engineer.
† Construction engineer.

The entire output of the station is taken through the two transformer banks previously described. A view of these and of the supporting structure was shown in the previous article (ELECTRICAL WORLD, March 8, 1941). From the diagram it will be observed that the transformers feed through single oil switches in the low side with no switches on the high side. They have been connected, however, to the two circuits between Glen Lyn and Roanoke, sectionalized at the plant in such manner that bus trouble on either bus section or generator trouble or transformer trouble will affect only one-half of the plant and still leave the other half connected to the remaining circuit.

CLAYTOR hydro plant of Appalachian Electric Power Company in August, 1940, operated through the highest flood recorded in the history of the New River

The five 132-kv. oil circuit breakers of the FHKO-339 type, having an interrupting capacity of 1,500,000 kva., are provided with ultra-high-speed reclosing mechanisms. Gang-operated disconnecting switches are used throughout the switching structure. Because of its location and the distance between the main power transformers and the switching structure each 132-kv. bus is protected by a "Thyrite" lightning arrester.

Metal-Clad 11-Kv. Bus

The 11-kv. bus and switching equipment, shown opposite, is of the metal-clad type, entirely housed in a steel compartment, provided with safety devices and interlocks so as to protect the operator from contact with any live parts. All of the circuit breakers installed in the factory-assembled 11-kv. switching cubicles are of the FH-126 type, oil insulated and having an interrupting capacity of 1,000,000 kva.

At the time the 11-kv. switching structure was being designed both water and air-blast breakers were in process of development. Neither design had, however, reached a point of sufficient development to warrant favorable consideration over the excellent experience gained with oil-poor circuit breakers such as the

THE 11-KV. bus and switch structure is of dead-front type, using breakers. Location adjacent to generator results in minimum length of low voltage connections

H-126. Decision was therefore made to proceed with the oil-insulated type of circuit breakers, but to make structural arrangements to facilitate change to the water or air type in the future. Since that time developments have been of a nature to lead to the conclusion that the inherent disadvantages of the water breaker do not warrant any optimism as to its future. Air blast, on the other hand, will undoubtedly move forward. Experience with it elsewhere on the American Gas & Electric Company system is most promising; it is not, however, of such a nature as to warrant any change at this location at this time.

Station auxiliary service has been provided by a simple arrangement consisting of two three-phase, 1,500-kva., 11,000/440-volt transformers each connected through its oil switch feeding from opposite sides of the 11-kv. bus sectionalizing switch. On page 70 is a simplified one-line diagram showing the 440-volt switching.

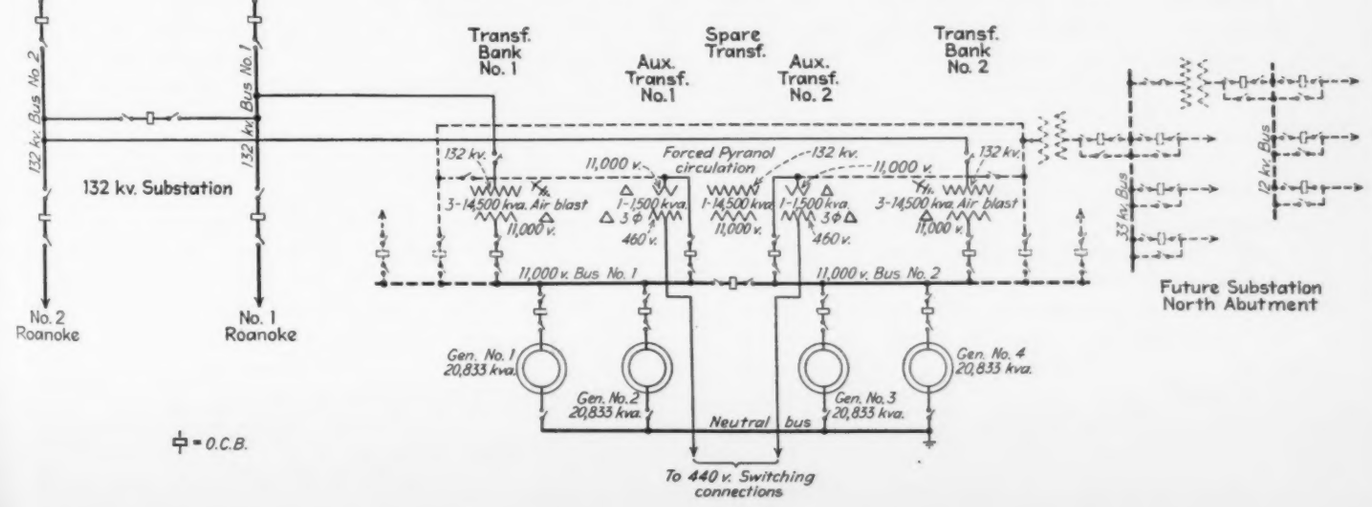
In case of trouble on either auxiliary transformer bank the 440-volt bus fed from that bank will be cleared from that bank and the bus tie breaker will close to the good 440-volt bus, thus maintaining service to all auxiliaries. Under normal conditions the bus tie breaker is operated open so as to minimize the fault current on the 440-volt feeders.

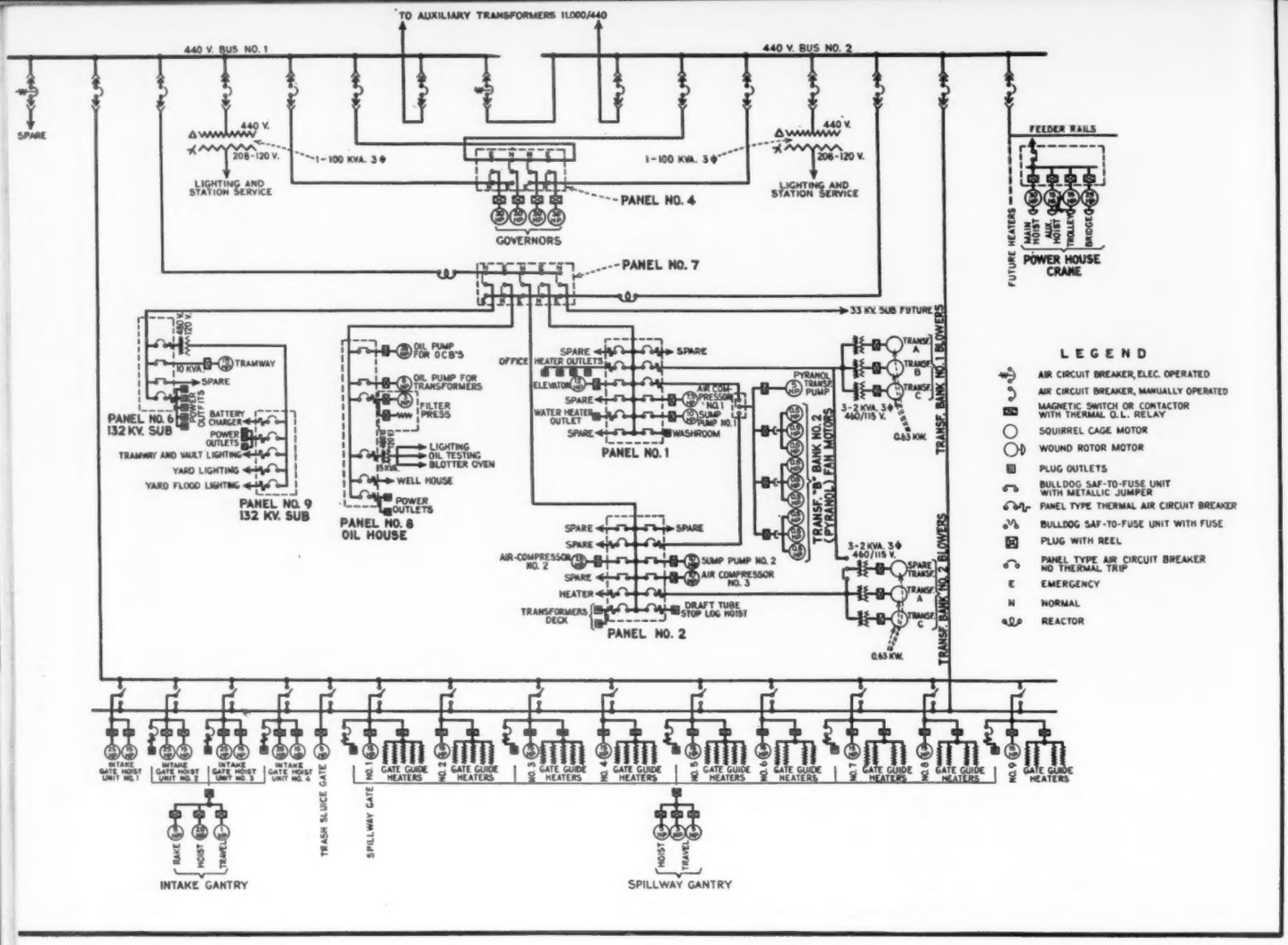
The distance between the power house and the switching structure is considerable.* This made it economical to provide duplicate control batteries particularly to supply the power required for closing the 132-kv. oil circuit breakers. This additional battery in the substation was located in a room built as a part of the foundation for the 132-kv. sectionalizing breaker.*

Control cables were installed between the switching station and the

* See previous article in "Electrical World," March 8, 1941.

EACH GENERATOR switched through single 11-kv. "oil-poor" oil switch to a common bus. Even by passes have been omitted on these switches on the basis that oil switch maintenance can be carried ou during periods of low water. The only concession to even the slightest elaborateness has been in th form of a sectionalizing 11,000-volt oil switch, to divide the bus into two parts in case of differentia relay sectionalization





ONE-LINE DIAGRAM of 440-volt switching connections. Each of the auxiliary feeders has been provided with one electrically operated air circuit breaker which is equipped with instantaneous relays for short-circuit protection. The branch circuits connected to the feeders are provided with contactors with thermal overload elements or with fuses, depending upon the type of equipment controlled. Provision has been made for interconnecting the 11-kv. auxiliary transformers with a shortly-expected-to-develop feeder to supply a new 33,000-volt and 12,000-volt supply center to be located on the north abutment of the dam

power house to enable the operator to perform certain special sectionalizing operations that might be called for by the system dispatcher in times of trouble elsewhere on the system, and to connect current and potential transformer secondaries to the relays located on the power house switchboard. For this purpose a non-metallic sheathed type of cable was laid in the ground alongside the inclined railway without any mechanical protection other than that provided by the earth covering. A similar type of control cable was used throughout the switchyard.

Control Board

The main control switchboard, located in the generator room, has mounted on it all of the relays, meters and control switches, etc., for the operation of both the power house and the switching station. It is entirely of metal construction, including the panels, which are built in a back-to-back arrangement. All equipment mounted on the fronts of the panels is of the dead-front type; doors have been provided at the two ends of the inclosure for easy inspection and maintenance.

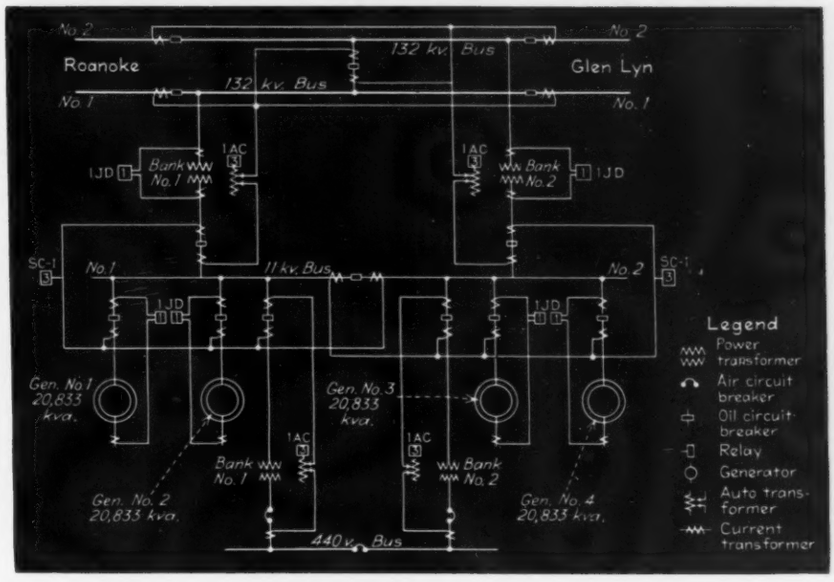
For the control and switching of the 440-volt auxiliary power circuits a metal-inclosed, dead-front, factory-built switchboard was provided. All of the air circuit breakers are equipped with a racking device and interlocks which permit the inspection of the circuit breakers after they have been tripped and the primary disconnecting devices withdrawn from contact. Primary disconnecting devices are all provided with silver-surfaced, high-pressure, line type of contacts.

The electrical connections of the plant and switching stations were planned so that practically all equipment, including buses, transformers, oil circuit breakers and generators, is covered by some form of differential protection. On page 69 is a simplified one-line protection diagram of the plant and switching station. From this it may readily be seen how the various differential circuits overlap, thus affording the maximum of protection. For instance, the No. 1 132-kv. bus and No. 1 main transformer bank have over-all differential protection from the line side of the 132-kv. line oil circuit breakers to the bus side of the 11-kv. oil circuit breaker of the transformer bank.

Simple relays of the time-delay overcurrent type are used in this scheme of protection. In addition to this, the transformer proper is protected by a faster and more sensitive differential scheme using a type "IJD" percentage unbalance relay. Again, the No. 1 11-kv. bus is protected by a simple bus differential

arrangement using instantaneous overcurrent relays. This arrangement covers the generator or transformer side of each of the individual oil circuit breakers on that section, thereby overlapping the No. 1 132-kv. bus and transformer over-all differential.

Differential relays of the percentage unbalance type are also installed around each generator. This protection also overlaps the 11-kv. bus differential, since the current transformers for this differential are located on the bus side of the generator oil circuit breakers. The No. 1 auxiliary bank differential protection employs type "IAC" relays similar to those used for the over-all 132-kv. bus and transformer differential. The No. 2 132-kv. bus, No. 2 transformer, No. 2 11-kv. bus, No. 2 auxiliary transformer and generators Nos. 3 and 4 are protected in a manner exactly similar to the corresponding parts on the half of the plant and yard just described in detail. By following out this fundamental scheme of protection throughout the plant trouble on any bus, in any transformer bank or in any generator will always be cleared within a minimum of time and with a minimum of resulting damage and the disturbance will be confined to one-half of the station only without affecting the other half.



SIMPLIFIED one-line diagram of differential circuits

Lines Differentially Relayed

For the protection of the 132-kv. lines emanating from the switching station bus a form of differential relaying is also employed. This is the latest type of instantaneous 1-cycle carrier-current protection, which is installed on about half of the 132-kv. lines of the American Gas & Electric Company Central System. This type of line protection will act to clear a fault in one cycle or less and has proved to be of inestimable value in maintaining normal system conditions during trouble.

As mentioned previously, the 132-kv. yard is designed for complete automatic operation. Each of the 132-kv. line oil circuit breakers is equipped with reclosing relays which will allow two automatic reclosures before a lockout occurs. The circuit breakers on the two lines to Glen Lyn are reclosed only when the incoming line is energized, without synchronizing if the bus is de-energized and after synchronizing or check synchronizing if the bus is energized. The circuit breakers on the two circuits to Roanoke reclose only when their respective buses are energized, without synchronizing when the line is de-energized and after synchronizing or check synchronizing if the line is energized. The bus tie oil circuit breakers reclose only when both buses are energized and then only by means of a check synchronizing device. In addition to the above automatic operation, each of the line breakers is equipped with ultra-high-speed reclosing mechanisms. This type of mechanism permits the re-energizing of the line within 18 cycles from the time that the tripping impulse is first given. When used in connection with 1-cycle carrier-current relaying, such as is installed at this point, these mechanisms, experience has shown, will reclose the oil circuit breakers and restore service in more than 90 per cent of line trippings without noticeable interference with system conditions.

The oil circuit breakers connecting the transformer banks to the 11-kv. buses reclose automatically only when the transformer banks are energized. They will reclose without synchronizing if the bus is de-energized and after synchronizing or check synchronizing if the bus is energized. The 11-kv. bus tie oil circuit breaker recloses automatically only if both 11-kv. buses are energized.

Generator Synchronizing

Generators, while not controlled by a float or other mechanical control device, are, nevertheless, automatically started and stopped. The attendant is required to operate only one switch, after which the automatic equipment brings the turbine and generator up to operating speed, synchronizes and loads without further attention. Because of the fact that considerably less supervision is employed on these generators than would be employed in a manually operated station, certain additional protective devices have been installed. These are designed to give relay action in case of the following contingencies:

1. Over-voltage.
2. Over-speed.
3. Turbine bearing over-temperature.
4. Governor oil pressure failure.
5. Stator over-temperature.
6. Bearing oil cooler water failure.
7. Field over-temperature.
8. Undervoltage.
9. Low oil level in the turbine bearing.
10. Field failure.
11. Generator out of step.
12. CO_2 fire protection.
13. Generator and turbine bearing over-temperature.

The protection afforded by the out-of-step relay is being used for the first time at Claytor. This was decided upon due to the experience had at the Marmet, London and Winfield plants. Within the first three months of operation at Claytor a case of trouble on one of the transformer low-tension circuits caused a severe short circuit. The generators were quickly removed from the line on the second swing out of step by means of this relay. Indications are that under the circumstances encountered the operation was not only desirable but possibly saved damage to the amortisseur

[*Continued on page 128*]

Editorials

S. B. WILLIAMS, *Editor*

Spokane Election a Stimulant to Lagging Spirits

ON MARCH 11 the people of Spokane went to the polls to vote on the acquisition by the city of the local distribution system of the Washington Water Power Company. By a margin of 1½ to 1 the voters rejected the proposition.

If this were merely another victory for private ownership and operation it would not be worth comment, but it was more than that. In was the best stimulant that electrical people who had begun to lose faith in their power to fight off the controlling forces of government ownership could have.

Here is a city but 90 miles from Grand Coulee, the largest single waterpower project in the country. It is the only nearby market for Coulee power. A large part of the state to the west has already entered the rolls of public operation.

From the Department of the Interior, from the Federal Power Commission, from the House of Representatives, from the Bonneville Authority there went out every kind of help to the public ownership forces. It was one of the best examples on record of the forces of government trying every trick to sell public ownership to the voters of a city.

For years the utilities of the Northwest have been fighting to retain their business, and they have spent money. Who wouldn't? The Federal Power Commission investigated this as though it were a misdemeanor, and although the investigation had been completed for some time the findings were released in the middle of the Spokane fight. The report was rushed into the Congressional Record and then, under franking privileges, rushed out to Spokane. Beautiful timing, even if it was a dud.

While there isn't any doubt but what this officious intervention by the hired help in Washington did more harm to the cause of municipal ownership than good, it is equally evident that the public isn't so dumb after all, when it comes to recognizing hypocrisy. It is pretty good proof that any company that has its house in order need not fear "all the king's horses and all the king's men." Good service, low rates, loyal employees and a progressive policy are tremendously effective against political promise.

The Public Interest in Utility Strikes

WHEN the Governor of Michigan earlier in the month threatened to use force to prevent a strike from disrupting Consumers Power service he served notice that the public convenience is paramount.

No group of employees should ever have the power to curtail public health, sanitation, amusement, livelihood or safety. That doesn't mean that such employees have no rights. It means that their rights must be protected in some other way than by strike.

Nor does the thesis of public convenience being paramount give to the employer any club to hold over the head of labor. In fact, he is charged with the responsibility of coming to an agreement with his people quicker, probably, than unregulated capital. Both labor and management are servants of the public when working for an electric utility.

If the two sides cannot agree in any collective bargaining there is only one thing left to do—arbitrate. Some day there will come state-enforced arbitration unless labor and management work out a mutually acceptable arbitration policy.

Utilization Voltage Spread

WHAT VOLTAGE the customer gets has always been a matter of primary concern to the distribution design engineer. Also to confirm this many regulatory commissions prescribe limits of voltage to be delivered to the service entrance. On the whole, therefore, the customers are getting well-regulated voltage. Nevertheless the situation is fraught with uncertainties. Lamp voltages have crept up from 110 to 120 as the virtues of somewhat higher secondary voltages gained acceptance. The more recent expansion of the four-wire, 120/208-volt network has added to the confusion regarding both lamps and motors, to resolve which there have been proposals of still higher lamp voltages. So where does it end and what spread of voltage shall the distribution engineer design for and deliver?

E.E.I. studies of utilization voltage are rapidly becoming tangible and concrete. When those studies were initiated a couple of years ago they were viewed by some as a bit vague, but the study was advanced to more specific stages by a paper by Howard P. Seelye of Detroit Edison at the recent transmission and distribution committee meeting. One primary objective is to define a definite range of utilization voltage for which the makers should design the utilization equipment to be put in the hands of utility customers. Another is to indicate desirable values for corresponding spread of service voltage to use as a guide in design of distribution systems, particularly with regard to allocation of parts of the permissible spread among interior wiring, meter and service entrance, secondary, transformer, primary circuit and regulator. Of course all of this will revolve about a reconciliation of the 115 or 120 volts desirable as an objective for lamps

and the somewhat wider spread that is tolerable for other utilization devices than lamps.

Of course, it is never going to be possible to provide all customers at all times with an absolutely equal and invariable voltage. But it will be a big contribution to economical design of distribution if the permissible limits at the utilization outlet can be explored actively and the tolerable spreads fixed with much more definiteness than now exists. As that happens the designers of distribution will focus even more positively on the aim of all distribution—to give every customer the best voltage that he needs but no better than he can afford to pay for.

Premium Labor

COMPLETION of a power plant was recently held up by insulation labor. While the job was straight 40 hours, only a handful of this kind of labor could be had, but as soon as the job went premium, with double for overtime, men flocked in from all over, some as far as a thousand miles away. In short order the force was quadrupled.

This was not an isolated case. Rather it was typical, we understand, of considerable contract work. Let it go premium and there is no shortage of skilled labor.

While it is difficult to blame the men for wanting to get as large pay checks as possible, especially after so many lean years, it looks as though it was becoming a racket. And yet there is little or nothing one can do about it—just another annoyance that comes with boom times.

Superposed Superposition With Mercury Vapor

SUPERPOSITION of high-pressure steam turbines has by no means exhausted all the possibilities open to it. There are still low-pressure plants, many at or near load centers, that can advantageously be salvaged by superposition with improvement in efficiency and yet escape from limitations imposed by available condensing water supply. There is, of course, the parallel opportunity to apply high-pressure condensing units. Consequently, there is still a broad field for the realization of thermodynamic benefits from employing as high temperatures as metals and equipments will stand.

Meanwhile, mercury vapor has been proving its merit as the outstanding substance on which to found a binary cycle which constitutes a next stage of superposition. General Electric turbine engineers Smith and Thompson, in a paper in this issue, are authority for the assertion that a mercury unit can be added with advantage to any steam plant regardless of its present range of temperature and pressure. The Kearny, South Meadow and Schenectady plants seem to have demonstrated the practicability of mercury vapor as a thermodynamic medium for which reliable equipment has been devised.

Caution with regard to prophecy and claim has marked the history of this development and that attitude still persists. Now, therefore, the release of the performance information on these plants can only be taken to indicate that mercury has arrived at trustworthy maturity.

Some will hold to a single-fluid cycle. They will argue the element of cost, of relative thermodynamic efficiencies, simplicity of design, doubtful availability of mercury in quantity, and so on. Others will see in the disclosed performance information about mercury units a justification for accepting mercury as an alternative. Whichever trend wins the more favor, the answer is thus available, not only for further gains in B.t.u. efficiency, but for overriding the growing insufficiency of condensing water, particularly at sites near the load centers. The more difficult it becomes to secure a sufficient supply of condensing water the more widespread will superpositioning become even to superposing with mercury already superposed units.

Keeping Construction Accident Record Down

DURING the 1937 upsurge of utility construction the safety record suffered a severe decline. That has since been improved as safety education was speeded up. Now the industry is again in a heavy construction period with the added problems of labor scarcity and of having to train green men and quickly. And as the draft proceeds this problem can be expected to be more acute. Will it have the effect of once more increasing the number and severity of accidents?

There are two sides to the problem of accident prevention—one is the training of the new employee and the other is reducing the carelessness of the older employee. Since the new men will be under the direction of experienced men the problem resolves itself into one of impressing the experienced men of the seriousness of training the new fellows both by instruction and by example. If the older men are careful and meticulous in their practice the newer men will absorb those qualities.

Where more experienced men might resent compulsory safety training for themselves, smart supervision will accomplish the same thing by enlisting their help in instructing the new men. Under that approach a review training course is no longer for the purpose of making them safer operators but to help them make others work safely.

Since an unsafe workman is a hazard not only to himself but frequently to his fellow workmen as well, the companies should have little difficulty enlisting the co-operation of the experienced members of their construction forces. This, of course, will not take the place of any organized safety training program. It can, however, augment that training and help to hold down the number of accidents that otherwise might occur as the result of speed in construction and training.

Always a Power Shortage Next Year

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

IN MARCH, 1942, when you are making out, with considerable anguish probably, your income tax return for 1941, you will have just been reading a solemn prediction from some Administration source, either the Federal Power Commission or some other agency, that a serious power shortage is impending, that it will materialize, unless something drastic is done right away, during the year 1943.

The following March, which will be 1943, again just as you are making out your income tax return, you will just have read an equally dire prediction. Only this time the power shortage will be forecast for 1944.

Funny? Not a bit. You are hereby invited to clip this to your income tax return, so that you will note it next March. The point is that these predictions of power shortages are timed, carefully, to coincide with the consideration of appropriation bills by Congress. They come early every winter, and are intended to obtain favorable consideration for appropriations for more public power developments.

The Record

Maybe the predictors really believe them, but we like to be charitable in calculating other people's intelligence. We prefer to believe that they are politically adroit.

Let's look at just a bit of the record. This prediction of shortages apparently began in the spring of 1935. Under date of April 6 of that year an FPC statement announced results of the commission's National Power Survey interim report. This said there would be a shortage in certain industrial areas of 2,325,000 kw. of generating capacity "upon the resumption of pre-depression industrial activity," and concluded that, having in mind obsolescence, the total gross requirements of new capacity amounted to 4,000,000 kw.

Two years later, in 1937, the Federal Reserve Board's index stood at the level of the pre-depression years of 1926 to 1929 inclusive. The predicted shortage was not manifest. Yet that was the best business year we have had since Coolidge.

The annual shortage prediction of 1936 was made on February 17, that year, by Basil Manly, vice-chairman of the Federal Power Commission. He told the conference of Mayors at New York, in reciting power shortages during the first world war:

> The situation would be far more serious today because the utilities generally have a much smaller reserve of generating facilities than they had at the beginning of the World War.

That wasn't true, but why quibble?

In 1937 the Federal Power Commission, in a press statement, said:

> Recent reports clearly indicate that many utilities are now operating without adequate reserve capacity and with no immediate provision to care for their rapidly growing loads. Under these conditions, if there should be a breakdown of one of their larger generating units, service would be interrupted, with serious inconvenience not only to the consuming public but also to commerce and industry. The danger of such breakdowns is greatly increased when generating plants are continuously operated at or above their rated capacity.

That cock didn't fight, either!

On August 17, 1937, Chairman McNinch continued to cry "Wolf." Before the House committee on flood control, considering the Merrimack River Valley and Connecticut River Valley flood-control situations, he said:

> . . . but I am unaware of any section of the U. S. now in which there is an excess of generated power. On the contrary, in most sections of the U. S. there is now threatened a very serious deficit in the generating capacity of private power companies, plus those federal government projects that are now under construction. One of the great problems of the private-power industry of New England is that there shall not be any further deficit of generating capacity permitted. Otherwise, they may run into a crisis because of the lack of adequate electric power.

What happened to that one? New England was not listed in Chairman Leland Olds' statement of the areas that might be short, even for 1942. Yet New England as a whole has added a relatively small amount of capacity since 1937, and of course federal development of power in the upper Connecticut Valley was blocked.

National Defense

Now we begin to reach the national defense angle of the predictions. In naming a special committee in charge of a war emergency power survey, on July 7, 1938, President Roosevelt wrote the committee members:

> The report regarding the supply of electric power in the event of a national emergency made to me by the War Department and the Federal Power Commission, in response to my request of March 18, 1938, have given me much concern. These studies have disclosed a shortage of power to meet the needs of the nation's industry in the event of war such as to contribute a serious threat to the national security.

Which was certainly telling them what to look for!

In its annual report for the fiscal year ended June 30, 1938 (page 23), the commission quoted its 1935 report as follows

> . . . the commission pointed out that, upon the resumption of normal industrial activity, power demands would call for additional generating capacity of between 3,000,000 and 4,000,000 kw., equal to 50 large plants, involving a capital expenditure of at least $300,000,000 . . .

It continues:

> Demands in the past three years have broken all pre-depression records, and there has been no corresponding increase in capacity.

And then:

> When industries resume in full force there is every prospect that demands will not only equal but exceed those of 1937, when production reached 121,049,630,000 kw.-hr.

When the National Power policy Committee was formed in October,

[*Continued on page 139*]

NEWS OF THE WEEK

Makes System Study to Insure Adequate Power

Rochester Gas & Electric Co. more than doubles construction budget in expansion of facilities — President Russell says company will spend $5,432,732 during year and add 15,000 kw. of capacity

A general system study of Rochester Gas & Electric Corp. is being made on the capacity and reliability of facilities which, company officials say, may indicate the required addition of new switchgear, new tie lines and the adoption of new protective schemes. Other studies are under way for 11-kv. lines to supply major defense loads and for the addition of 4,150-volt lines to supply general load growth.

President Herman Russell said that the company this year will spend more than twice what it did last year on additions and improvements to the system. Total construction estimates for 1941 are $5,432,732, against actual expenditures of $2,255,800 last year.

New 15,000-Kw. Unit

The major item in the budget is steam-electric generation, for which $2,840,000 has been allocated. A new 15,000-kw. high-pressure condensing turbo-generator will go into operation this year.

The allocation of the construction budget compares as follows:

	1941 Estimated	1940 Actual
Hydro-electric generation	$7,000	$14,259
Steam electric generation	2,840,000	1,132,314
Transmission lines	656,135	205,011
Substations	719,597	83,276
Distribution	1,207,500	811,940
Miscellaneous	2,500	9,000
Total	$5,432,732	$2,255,800

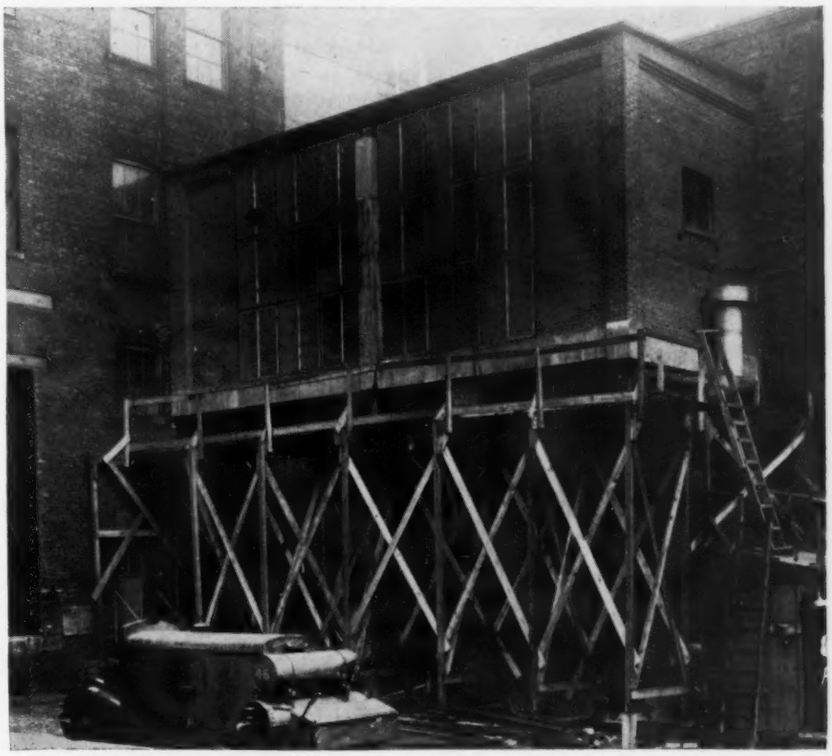
The company as yet has not determined the method by which the construction program will be financed, it was stated.

During 1940 approximately 30 miles of 33-kv. transmission line and four substations were constructed to provide 60-cycle service in a territory formerly served by 25-cycle. This work is expected to be completed by the end of this year, with the exception of a few large industrial customers.

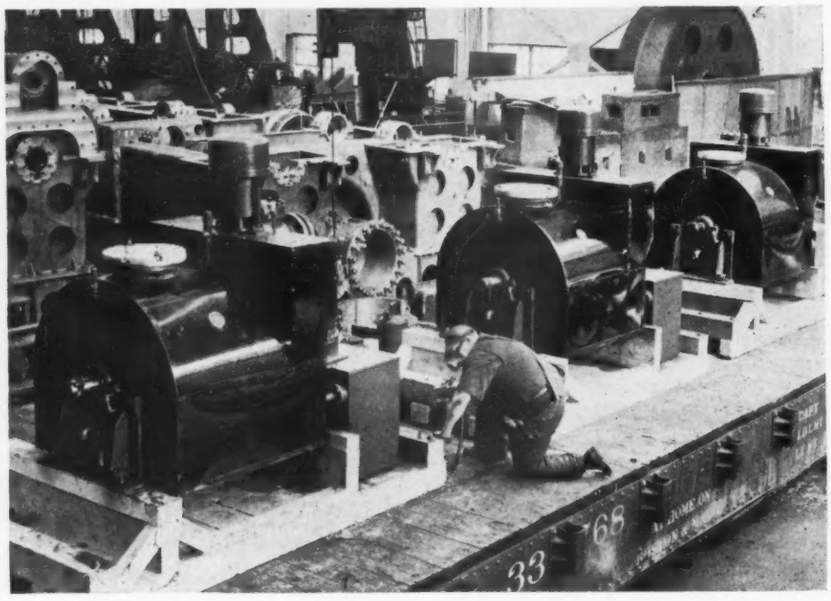
Street improvement projects required large expenditures for conduit and cable relocation and new street lighting in 1940. This type of work will be a major item during this year due to the abandonment of the trolley system in the city of Rochester, it was declared.

A high-pressure boiler was ordered and installed at Station 3, the main steam plant, in 1940. This unit went into service last October. It was the fourth steam generator of this type and size installed since 1935. Each of these units is capable of generating 250,000 lb. of steam per hour at 650 lb. and 750 deg.

Always looking toward greater efficiency and reliability of customer service, the Rochester utility will air con-



AIR CLEANER—Precipitator building for Station 3 of Rochester Gas & Electric Corp., where incoming air is cleaned of dust and all foreign particles, heated in winter and cooled in summer, before it is picked up by two fans for turbine room circulation



READY FOR A RIDE—Three boiler-feed pump drives being loaded at the Lynn River Works for shipment to the Joliet station of Public Service Co. of Northern Illinois, where they will be used in connection with a 50,000-kw. General Electric turbo-generator. Each drive is rated 1,020 hp., type DS-60, five-stage, 3,600 r.p.m.

dition the main switchboard and turbine rooms at Station 3 this year to protect the intricate precision equipment, to reduce maintenance and to increase general reliability of service. All incoming air to these rooms is to pass through electrostatic precipitators for removal of dust and other foreign materials which might infiltrate into the finely machined mechanisms, causing fouled contacts, severe wear on moving parts and dirty generator coils, preventing proper dissipation of heat.

The company stated that during 1941 a large industrial changeover project of supplying 60-cycle current to factories and other industrial plants will be undertaken and there will be several extensions of 11-kv. facilities for new customers. Additions to substations are contemplated and a 10,000-kva. lowering transformer will be installed at a major generating station. Several miles of transmission line are to be built south of Rochester. A 15,000-kw. high-pressure condensing turbo-generator is on order for Station 3. Preparatory field work for its installation is well advanced and the unit will go into service this year.

During 1940 the company constructed 67 miles of rural lines and it is estimated that 50 more miles will be added this year. A total of 305 new rural customers were added in 1940 and it is estimated that 200 more will go on the lines this year. The average annual use per customer is 1,020 kw.-hr.

Appliance sales, exclusive of dealers for 1939, totaled $438,691, including $291,885 electric. These produced an E.A.R. of $63,600. In 1940 sales totaled $508,991, of which $362,746 were electric. E.A.R. was $74,000. The forecast for 1941 is $600,000, of which $440,000 constitutes electric appliances. E.A.R. is set at $86,000.

The average annual use per residential customer was 767 kw.-hr. in 1939 and 812 in 1940.

The company is taking, or has taken, all protective measures against possible sabotage. These include drastic curtailment of visits to company properties, rigid enforcement of pass system for visitors, provision for identification of employees required to enter company properties other than where employed, and educational effort among employees to encourage individual responsibility for safeguarding property.

A power shortage is not likely to develop in the Rochester area for the company is making studies of power loads and is attempting to predict future loads by projection of past trends, the addition of known defense loads and an allowance for prospective customers.

E.E.I. Files With SEC

Trustees of the Edison Electric Institute voted at the board meeting last week to file a report with the SEC as a service organization under section 13 of the utility act. When the question of SEC jurisdiction was raised a few months ago E.E.I. questioned the commission's authority to act. Missouri Association of Public Utilities filed with SEC this week.

Consolidated Edison Co. of New York, Niagara Hudson Power System and Boston Edison Co. have decided to withdraw from membership in the E.E.I. because the Institute was required to register under the Utility Act.

NEWS BRIEFS

SEC MEMBERS are immune from suit for certain acts found to be within the general scope of their authority. The U. S. Court of Appeals for the District of Columbia has affirmed a lower court ruling to that effect.

ALABAMA POWER CO. is offering $100 in cash prizes for the oldest electric bills among its customers. A $50 prize will go for the oldest bill and $5 each for the next ten oldest bills. The bills, to compare present cost of electricity, will be used as the basis for a series of advertisements.

AT ITS RECENT annual convention in Milwaukee the Wisconsin Electrical Association adopted a resolution amending its constitution to include utility representatives on the board of directors and the executive committee.

NEW JERSEY'S Public Service Electric & Gas Co. has lent its industrial representative, W. D. Relyea, to the New Jersey Council to assist in obtaining sub-contracts for smaller industries in connection with the defense program.

OFFICIALS OF Central Illinois Public Service Co. startled the statistically minded utility industry with news that their "average" employee has served the company for ten years, is 38.07 years old and that 81.48 per cent were born in the state. Of the balance, 10.07 per cent were born in contiguous states and 8.45 per cent in other states than those mentioned. These facts popped up when the company checked service records in inaugurating a service annuity plan, placed in effect the first of the year.

THE National Better Light-Better Sight Bureau is pepping its newspaper promotion with a series of feature cartoons on the story of light and seeing throughout the ages. It has been a long road from the greasy moss of the caveman to the I.E.S. lamp. It is "Eyes Right" for the bureau.

A 40-MINUTE FILM in color covering details of the municipal development on the Skagit River, highlighted by unusual shots of wild life and the scenic wonders that lie in the rugged country of the Skagit power basin, has been produced by employees of Seattle's City Light Department.

Consumers Power to Add Two Turbo-Generators

Vice-President Karn says 35,000-kw. unit at Weadock and 50,000-kw. unit at Morrow plants to be ready this year — Company will spend $14,000,000 on extensions and improvements

Consumers Power Co. will spend $14,000,000 on additions to and improvements of its electric and gas facilities in 1941, awarding to Dan E. Karn, vice-president and general manager.

Electric generating capacity will be increased 17 per cent during the year, Mr. Karn said, through expansion of the John C. Weadock and Bryce E. Morrow plants. An additional 35,000-kw. turbo-generator will go into operation in the Weadock plant April 1, and an additional 50,000-kw. turbo-generator is scheduled to be ready for service in the Morrow plant September 1. The Weadock plant is on Saginaw Bay at Bay City and the Morrow plant is on the Kalamazoo River at Comstock.

To Meet Power Loads

"These new units were ordered some time ago," said Mr. Karn, "for it takes approximately two years to obtain delivery on such equipment. They will go into service at an opportune time, placing the company in a still better position to meet the demands of the national defense program."

Mr. Karn revealed that still another 50,000-kw. turbo-generator has been ordered for the Weadock plant. It will go into operation in the summer of 1942.

Enlargement of the Morrow plant to accommodate its new 50,000-kw. unit was begun last September. The turbine room wing is being extended and a dam three-quarters of a mile long is being built across the Kalamazoo River. Behind this dam a pond is to stabilize the flow of cooling water through the plant, which, like the Weadock plant, is a steam-electric station of advanced design.

The turbine room wing of the Weadock plant will be extended, beginning next autumn, preparatory to the installation of the 50,000-kw. unit.

Aside from the increase in generating capacity, electric service will be reinforced through construction of several important substations and transmission lines and through many substation and line improvement projects.

The new 140,000-volt transmission line between Lansing and Flint will be completed early in the year. This line will facilitate the transfer of large blocks of power from one part of the state to another as load conditions demand.

As a further means of meeting Flint's increasing power needs and to give additional flexibility to the city's electric facilities, three new substations will be built. A new 140,000-volt substation will be erected adjacent to the present Hemphill substation. New distribution substations will rise on Fifteenth Street, adjacent to an existing substation, and on Pasadena Avenue.

Because of a rapid growth of electric demand in Kalamazoo, a new distribution substation will be built near the south limits of the city. It will receive power at 44,000 volts and transform it to 5,000 volts, then distribute it through the southern part of Kalamazoo and surrounding territory via three distribution circuits. Relieved of this area, Kalamazoo's existing substation and distribution facilities will be ready to meet the greater demands which are expected to be made upon them.

In Jackson a new substation will be built in the vicinity of Francis and South streets to serve southern Jackson and Vandercook Lake. It will receive power at 44,000 volts from the Cement City substation and send it out at 5,000 volts over two distribution circuits.

New Lines Planned

In anticipation of further industrial growth in the Adrian area, an existing 44,000-volt transmission line from Jackson and Cement City will be converted to 140,000-volt operation and additional transformer capacity will be provided in the Beecher Street substation at Adrian.

A 22,000-volt line will be built from the Saginaw River plant (Zilwaukee) to the Florence Street substation in Saginaw, a distance of 7¼ miles, as a means of meeting increasing loads in this area.

Consumers plan to spend approximately $1,000,000 on rural electric line extensions during the year and approximately $2,000,000 on other electric line extensions to handle new residential and commercial business. Gas main extensions for new business, it is estimated, will cost $565,000.

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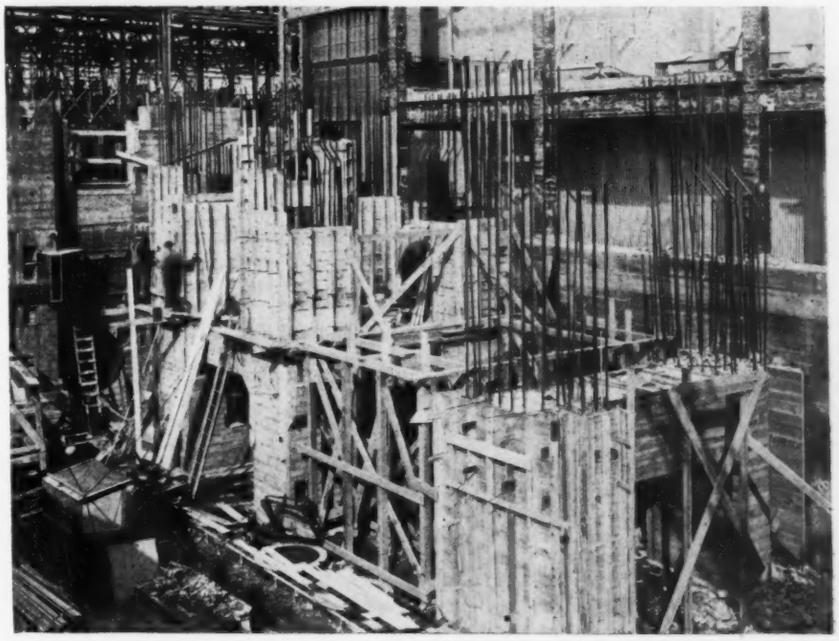
Let Contracts for Work on White River Project

The Utah Construction Co., Ogden, Utah, and the Morrison-Knudsen Co., Inc., Boise, Idaho, have been awarded contracts totaling $10,778,728 for construction of the Norfork Dam, second of a projected series of floor-control



PLANT ADDITION—Consumers Power Co. is building this addition to its Bryce E. Morrow steam-electric plant at Comstock, Mich., where a 50,000-kw. General Electric turbo-generator will be installed and put into service next fall. This is part of the company's $14,000,000 expansion and improvement construction program for 1941

and power dams along the White River and its tributaries in the Arkansas Valley. Another contract, for $1,779,840, was awarded the Universal-Atlas Cement Corp., Chicago, to provide portland cement for the job.

Solely a flood-control project at present, plans for the dam include installation of four 15½-ft. steel penstocks to provide for initial installation of 60,000 kw. of power when Congress authorizes it. The dam is a concrete gravity type, with a 568-ft. spillway, over-all length of 2,300 ft. and over-all height of 568 ft. The job is to be completed in 1,200 days after work begins.

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U. S. and Canada Sign St. Lawrence Pact

An agreement between the United States and Canada for the construction of the St. Lawrence project has been signed. President Roosevelt has asked Congress for approvement and appropriation.

A single dam is to be built at Beauharnois Island with a power house on each side. A side canal will be built on the U. S. side and there will be one navigation lock of 30 ft. depth and the channel will be 27 ft. deep. A central dam will be built at Iroquois Point.

Engineers estimate that the solely navigation portion will be $38,578,000. The cost primarily allocated to power is $96,804,000, divided, structures, tailrace and head $46,476,000 and machinery and equipment $50,328,000. The expense common to navigation and power is $130,788,000. Total cost of the project will be $266,170,000.

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PUDs Seek to Purchase Oregon Utility Properties

Conferences with PUD officials and the Eastern Oregon Light & Power Co. relative to a system-wide acquisition of the utility's generating, transmission and distribution properties will begin in the near future, according to Bonneville Power Administration officials.

Studies of the company's books and records by Bonneville representatives have been under way for several weeks. Under present plans, Bonneville would purchase certain high-voltage transmission lines and the PUDs would purchase distribution lines and small generating plants. The system would be connected with Bonneville power network by the construction of a line from Pendleton to LaGrande.

Warns Stockholders of War Seriousness

Consolidated Edison Co. of New York is prepared and anxious and desires to co-operate in every conceivable way with the defense program, Floyd L. Carlisle, chairman, told stockholders at their annual meeting this week. Mr. Carlisle warned of possible serious consequences that the impact of the war might have on the affairs of the company. He saw possible higher taxes and operating costs as well as restrictions on use of power by luxury industries.

"In my judgment it is more than conceivable that as the battle of Britain proceeds more and more this country will be drawn into it," Mr. Carlisle declared. He saw the possibilities that the operations of public utilities would

Chairman Floyd L. Carlisle addressing stockholders at meeting

be placed under similar control as those operating in war areas.

It was stated by Mr. Carlisle that present depreciation reserves total approximately $90,000,000, and that over the next few years the reserve would be so large that no government political body will be able to contend that it is not sufficient.

Strong opposition to payment of pensions in excess of $5,000 was expressed by a number of stockholders present and by proxy. However, pension of $10,416, $13,416 and $20,000 were voted to retiring officers by a majority of 7,881,970 shares present or represented by proxy. There were 925,077 votes against the lowest pension, 995,424 against the second and 1,044,074 against the largest sum.

Mr. Carlisle said that the company paid the largest tax bill of any utility or any company in any industry. It totaled $58,520,682, against $25,559,970 in 1929.

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SEC Sets "Blueprint" for C. & S. System

In its third major "blueprint" for holding company compliance with the "death sentence," SEC offers tentative conclusion that the Commonwealth & Southern Corp. must reduce itself to one of three of its electric units—Consumers Power Co. in Michigan, Alabama Power Co. or Georgia Power Co.

If Commonwealth & Southern elects to keep Consumers, SEC feels it cannot keep any of its other properties under the Big B integration clause. If it elects Alabama, it might be able to justify retention of Mississippi and Florida properties; if Georgia, it might justify South Carolina.

An ominous indication, however, that SEC feels that clause C of Section 11(b)(1) might prevent keeping all properties now operated by any of these systems is contained in the "blueprint." SEC deems it unnecessary to reach tentative conclusions regarding the application of clause C, but it added that it felt "each of these state-wide areas either exceeds, or in any event approaches, the maximum size which can be so retained."

Size Important

The commission's remarks regarding application of clause C marks the first time this phase of the "death sentence" section has been raised in a "blueprint" report regarding the size of properties now operated as a unit. SEC's utilities division staff in its report to the commission made pointed reference to its theory that if any C. & S. major units—Consumers, Georgia or Alabama—were a single corporation without holding company control it would not be subject to the holding company act. This hint appears to be similar to that the utilities staff included in its report on Engineers Public Service suggesting that the easiest way for EPS to comply with the act would be voluntary dissolution of the top holding company to free its individual units.

Commonwealth & Southern was directed to reply to SEC's tentative findings at a hearing April 3 and to be prepared at that time to answer a show cause order why it should not be directed to divest itself either of its northern properties in Michigan, Illinois, Indiana, Ohio and Pennsylvania or its southern properties in Mississippi, Alabama, Florida, Georgia and South Carolina. This drastic move will dismember

what has been considered from the first inception of the act that the southern properties constituted a single geographical interconnected utilities system.

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Removal of 15% Surcharge on Memphis Rates Opposed

Removal now of the 15 per cent surcharge on electric rates would "seriously threaten" the financial stability of the Memphis Light, Gas & Water Division, according to Major Thomas H. Allen, president. "If the surcharge was removed now we could not operate with a safe margin of profit," he contended.

During 1940 the electric department earned $967,000, of which the surcharge accounted for approximately $570,000. The department spent $344,000 for capital improvements to meet power demands and $122,000 put in the bond sinking fund. If the surcharge had not been in effect, Major Allen said, the department would have gone into debt by $69,000.

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All Nebraska Towns May Purchase Utility Systems

Nebraska cities and villages may acquire any utility system located within their boundaries by right of eminent domain and issuance of revenue bonds under the two new laws which have been passed and approved by the Governor. This power until now has been limited only to cities of the first class and could be used only in purchase of power plants and system.

It is provided in the law that any city or village, if authorized by a majority of the voters, can appropriate any water works, water works system, gas plant, electric light or power plant, heating plant or street railway system. It further provides that although a franchise for construction and operation of any such plant or system has not expired the town may take over if the voters approve.

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Wins $2,748,362 Tax Suit

The Illinois Supreme Court has affirmed a decree of the Cook County Circuit Court dismissing a suit by the state of Illinois to recover $2,748,362 as the unpaid balance of personal property taxes levied against Commonwealth Edison Co. for 1932. The court held that the assessments were arbitrary, excessive, illegal and fraudulent. It also held that the concern's underground cement conduits are not assessable as tangible personal property.

Engineers Talk Gains in Tools and Methods

Southeastern group hears of measures to avert line outages, improve voltage, reduce distribution expenses and minimize flicker — Meeting in Savannah last week drew large representation

Measures which helped to hold line forces in five years to a 7 per cent increase despite a 17 per cent decrease in working hours and increases of 20 per cent in number of customers and 25 per cent in number of poles were described by Vice-President George S. Humphrey of Potomac Edison at the Southeastern Electric Exchange meetings in Savannah, Ga., last week. Eternal vigilance and attention to minutiæ are the price for such economies. Particularly must tools and automotive equipment be kept durable and serviceable. Chairman Lewis Payne of the section (operating and engineering) looks for a 100,000-mile vehicle.

Live-line Maintenance

Diversity of opinion about live-line maintenance marked discussion of a paper and movie by I. W. Gross (American Gas & Electric Service Corp.) about protective equipment. A trend was evident toward the 20-kv. gloves and also a lesser trend toward using them without leather protectors. J. L. Shores (Alabama Power) sought reassurance on use of rubber above 3 kv., citing 60 months service life in coastal areas, but much less 150 miles inland. J. A. Jones (Carolina Power & Light) favored hot-line tools on 12 kv. and T. L. White (Appalachian Electric Power) said they were safer and just as fast as gloves.

C. E. Arvidson's (Commonwealth & Southern) explanation of the move to standardize utilization voltages, perhaps in the range 110–125, was interpreted by H. G. Harvey (Westinghouse) as a plea for abandonment of 125 volts, but he feared the needs of the networks would prevent it. V. R. Parrack (Carolina Power & Light) reminded about the necessary derating of transformers subjected to increased excitation losses with elevated voltage.

Seven years' experience with step regulators has led to no normal-service replacement of contacts, reported F. W. Bush (Allis-Chalmers). Inspection, he said, is tending toward a ten-year period. The step type is gaining rapid acceptance, with the 5/8 percent steps well established. Integrated time delay is working out well.

Capacities should always be close to the reactive source, said Frank Starr (General Electric), adding that New York is considering capacitors at centers of four-block network areas to postpone extension of 13-kv. feeders at seven times the cost. Three low-cost capacitors with film-gap for short-circuit protection are out on trial on rural circuits.

Institutional Loads

To serve 75–300 kw. institutional loads by underground vault from overhead supply, P. B. Boyd and R. O. Loomis (Georgia Power) computed several schemes with estimated annual outage minutes from 2 to 88. They found least cost per kva. per annual outage-minute saved to reside (at $0.032) in duplicate 4-kv., three-conductor cable with potheads at both ends of the spare, but only one bank of transformers.

Flicker from 5.7-volt dips at six per second due to a flashing theater-marquee sign was reduced to 2 volts at 28 dips per second merely by putting all the flashing load on one side of a three-wire service. This refutation of familiar balanced-load principles was said by V. R. Parrack to rest in superposing the four cycling loads and thus reducing current fluctuation from 35 to 9 amp.

"The industry cannot be complacent in the face of hazards confronting it," said President A. W. Higgings at a luncheon attended by the 150 members of the section. "They must act to protect their own jobs by grasping every opportunity to impart to the public the merits of utility service."

W. L. Rush said his company (Louisiana Power & Light) serves 50,212 customers in 267 communities over 3,228 miles of 2.4 to 110 kv. line and the district representative plan is "just that" in all its ramifications. He quoted part of a report from one whose territory ends everywhere in swamps and whose customers report outages by mail. It was amusing to note that no conceivable functions failed to be included in his enumeration.

The final session was devoted to intimate experiences and the evolving policy with regard to personnel detached for defense. The trend is to reallocate assignments, add few skilled men at the top, fill in at the apprentice levels and perhaps, before long, employ women for clerical and drafting jobs.

Long Island Lighting Hit by Heavy Taxes

Certain profitable projects have been deferred by Long Island Lighting Co. because additional funds were not available, Edward F. Barrett, president, told stockholders last week at the annual meeting. Mr. Barrett said that last year the company spent $2,589,570 on additions that were absolutely necessary.

During 1940 the company added 6,296 electric and 3,780 gas customers to the lines. "We were glad to obtain so many new customers, but needed large new investments for facilities to take care of them," Mr. Barrett said. Practically all of the growth was in the residential class and was the largest experienced by the company in one year since 1930.

Net income for 1940 was $1,572,630, against $1,425,419 in 1939. The company set aside $576,000 from net, by order of the Public Service Commission, which was invested in new utility plant. No dividends were paid because of the necessity of using all available funds in the business. During the year the company reduced its notes payable by $815,000. "There has been no practicable source of sufficient funds for expansion, except from operations.

"Taxes continued a relentless upward trend," Mr. Barrett said. The total has doubled in the last four years and now greatly exceeds net income.

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Graham Claytor Authorized to Hold Utility Positions

The Federal Power Commission has authorized Graham Claytor, vice-president of American Gas & Electric Service Corp., to hold the position of vice-president and director of Ohio Power Co., and as vice-president of Indiana & Michigan Electric Co. and Indiana General Service Co. The FPC said that neither public nor private interest will be adversely affected by holding of these positions.

Mr. Claytor is now vice-president and director of Kingsport Utilities, Inc., Kentucky & West Virginia Power Co., Inc., Kanawha Valley Power Co. and Appalachian Electric Power Co.

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Sells Plattsburg System

Transfer of the distribution system of New York State Electric & Gas Corp. to the city of Plattsburg was assured this week when Chairman Milo R. Maltbie of the Public Service Commission signed an order approving the transaction. The city is to pay $180,000, or $30,000 less than was called for in the original agreement. The city will construct a municipal system, partly with federal funds. The commission held that the original price of $210,000 for the private system was too high.

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Spokane Final Vote

The final vote on the Spokane election of March 11, at which the proposition for municipal ownership of the electric distribution system of Washington Water Power Co. was defeated, was 26,609 against and 17,279 for.

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Dr. Morgan Loses Appeal

Dr. Arthur E. Morgan, ousted by President Roosevelt in March, 1938, as chairman of the Tennessee Valley Authority, lost his battle for reinstatement and back salary of $4,583 last Monday when the Supreme Court refused to review a decision of the Sixth Circuit Court against him. Dr. Morgan had held that the removal was illegal.

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A.I.E.E. Postpones Meeting

Indefinite postponement of the Great Lakes District meeting heretofore scheduled to be held in Fort Wayne, Ind., April 23–25, was recently authorized by the board of directors of the American Institute of Electrical Engineers.

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Must File for License

Concluding in a unanimous opinion "that the Connecticut River from its mouth up to and beyond Bellows Falls is navigable water of the United States," the Federal Power Commission has ordered that the Bellows Falls Hydro-Electric Corp. file, on or before May 5, an application under the Federal Power Act for a license for its project.

COMING MEETINGS

Northwest Electric Light and Power Association—Annual meeting, business development section, Davenport Hotel, Spokane, Wash., March 27-29. Daryl B. Leonard, chairman, Pacific Power & Light Co., Yakima, Engineering and operation section, Portland, Ore., April 16-18, Paul P. Ashworth, chairman, Telluride Power Co., Richfield, Utah.

Missouri Valley Electric Association—Engineering Conference, Continental Hotel, Kansas City, Mo., March 27-28; rural and sales conference April 14-15; Spring accounting conference May 22-23, also Continental Hotel, Kansas City, Mo. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

Edison Electric Institute—Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 31-April 3; annual convention, Buffalo, N. Y., June 2-5. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York.

American Society of Mechanical Engineers—Spring meeting, Atlanta, Ga., April 1-3; semi-annual meeting, Kansas City, Mo., June 16-20. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National Accounting Conference—American Gas Association-Edison Electric Institute, Netherland Plaza Hotel, Cincinnati, Ohio, April 7-8.

Midwest Power Conference—Fourth annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles N. Nash, conference secretary, Illinois Institute of Technology, 3300 Federal St., Chicago, Ill.

Maryland Utilities Association—Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 18. G. F. Jones, secretary, Potomac Electric Power Co. Building, Washington, D. C.

Electrochemical Society—Spring meeting, Cleveland, Ohio, April 16-19. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Porcelain Enamel Institute—Annual meeting, French Lick Springs Hotel, French Lick, Ind., April 17-18.

Greater New York Safety Council—Annual safety convention and exhibit, New York, N. Y., April 22-25. Greater New York Safety Council, Inc., Lincoln Building, 60 East 42d St., New York.

Missouri Association of Public Utilities—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 23-25. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Illuminating Engineering Society—Pacific Division, second annual lighting conference, Pacific Gas & Electric Co. auditorium, 245 Market St., San Francisco, April 25-26. William P. Bear, general chairman, 245 Market St., San Francisco.

Arkansas Utilities Association—Annual convention, Arlington Hotel, Hot Springs National Park, Ark., April 28-29. R. E. Ritchie, secretary, Post Office Box 551, Little Rock, Ark.

Association of Iron and Steel Engineers—Spring conference, Youngstown, Ohio, April 28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

American Institute of Electrical Engineers—North Eastern District, Rochester, N. Y., April 30-May 2; summer meeting, Toronto, Canada, June 16-20. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

Southeastern Electric Exchange—Annual conference, Bon Air Hotel, Augusta, Ga., May 1-3. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

National Metal Trades Association—Annual convention, Palmer House, Chicago, Ill., May 8-9. Harry S. Flynn, secretary, 122 S. Michigan Av., Chicago, Ill.

National Electrical Manufacturers Association—Spring meeting, The Homestead, Hot Springs, Va., May 11-15. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

National Fire Protection Association—Annual meeting, Royal York Hotel, Toronto, Canada, May 12-17. Robert S. Moulton technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 18-22. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Pacific Coast Electrical Association—Annual convention, Hotel del Coronado, Coronado, Calif., May 21-24.

Empire State Gas & Electric Association—Electric operating group, Van Curler Hotel, Schenectady, N. Y., May 23. George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

National Association of Purchasing Agents—Annual convention, Chicago, Ill., May 26-29. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

American Society for Testing Materials—Annual meeting, Palmer House, Chicago, Ill., June 23-27. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Power Output off Slightly in Week

Power production for the week ended March 15 showed a decline of approximately 0.6 per cent from the preceding week, although it was 14.5 per cent above the level of a year ago. It was a seasonal drop and in no way reflects a reversal of the trend during past weeks.

The Edison Electric Institute reported total output of 2,817,893,000 kw.-hr. for the week, a gain of approximately 26.6 per cent above the corresponding week of 1939.

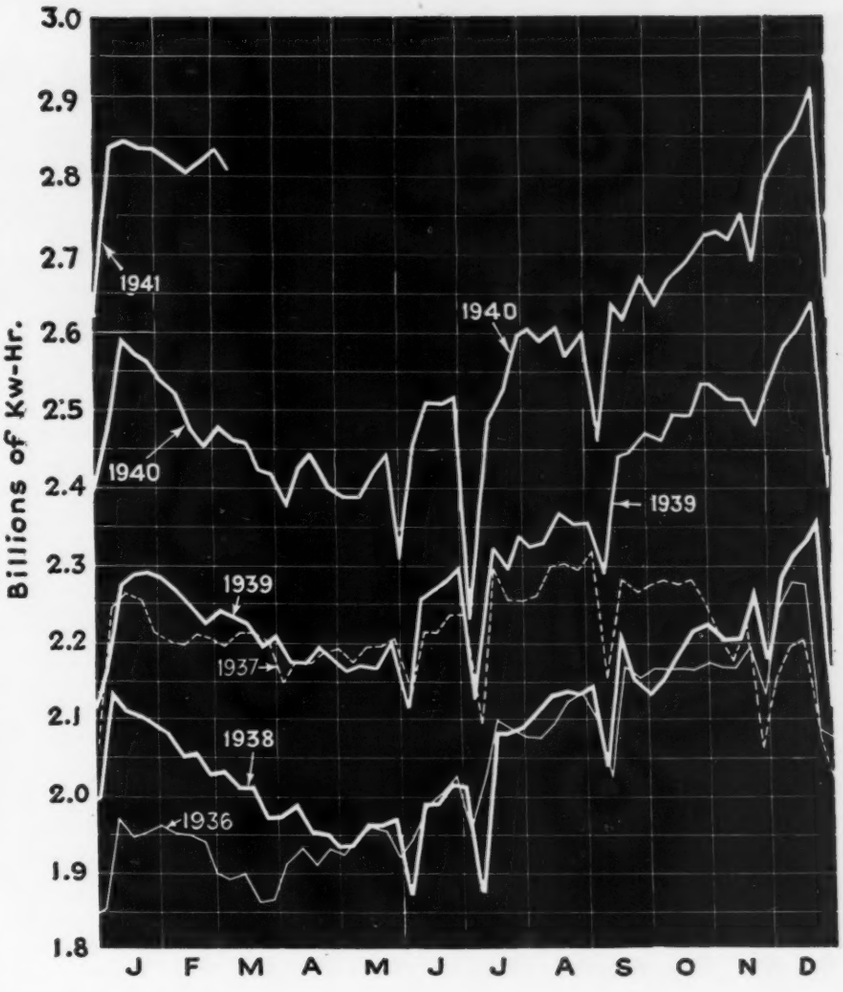
Since most defense industries are now operating at or near capacity indications are that the normal seasonal downtrend is likely to be followed because the rate of lighting load will decline. This condition will exist provided industrial plants do not increase the number of work shifts. Many industrialists believe that it will be necessary for most plants to increase the number of hours in the work week and operate on a 24-hour basis. In this instance power output is likely to turn up sharply.

Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Mar. 15	2,817	Mar. 16	2,460	Mar. 18	2,225
Mar. 8	2,835	Mar. 9	2,464	Mar. 11	2,238
Mar. 1	2,825	Mar. 2	2,479	Mar. 4	2,244
Feb. 22	2,820	Feb. 24	2,455	Feb. 25	2,226
Feb. 15	2,810	Feb. 17	2,476	Feb. 18	2,249
Feb. 8	2,824	Feb. 10	2,523	Feb. 11	2,268
Feb. 1	2,830	Feb. 3	2,541	Feb. 4	2,287
Jan. 25	2,830	Jan. 27	2,566	Jan. 28	2,293
Jan. 18	2,844	Jan. 20	2,572	Jan. 21	2,290
Jan. 11	2,835	Jan. 13	2,593	Jan. 14	2,270

Per Cent Change from Previous Week

	Week Ending		
	Mar. 15	Mar. 8	Mar. 1
New England	+16.5	+17.1	+13.3
Middle Atlantic	+12.1	+11.8	+10.6
Central Industrial	+18.5	+18.1	+16.7
West Central	+ 8.8	+ 9.1	+10.7
Southern States	+17.4	+19.6	+17.5
Rocky Mountain	+10.5	+12.3	+10.7
Pacific	+ 8.7	+11.5	+10.9
United States	+14.5	+15.1	+14.0



REA Publishes Report on Co-Ops Operations

REA has published a report showing the financial status of each individual co-operative. It is a comprehensive report which shows the operation of each REA co-operative.

As of October 1, 1940, there were 129 borrowers making advance payments of $1,045,072 and there were nineteen co-operatives overdue on interest in the amount of $40,035 and 24 overdue on principal of $81,474 on loans for lines and generating plants.

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Court Refuses Injunction

Michigan Supreme Court has refused to enjoin Michigan Gas & Electric Corp. from operating a local power business in the village of Constantine in competition with a municipal utility. The court held the corporation was operating under a state charter continuing at least until 1958 and preceding a village charter which expired in 1933.

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Tampa Rate Case Appeal Heard in Supreme Court

The Florida Supreme Court heard recently the Tampa Electric Co.'s appeal from rate reductions ordered by the Tampa Utilities Board. The board, created by the 1939 Legislature, ordered reductions of about 30 per cent in consumer rates charged by the company.

Circuit Judge Ira A. Hutchinson of Panama City, assigned to hear the rate case by former Gov. Fred P. Cone, upheld the utilities board's orders and overruled the company's contentions that its street car system should be included as part of the investment on which electric rates are fixed.

The company then appealed to the high court. The court reserved decision.

United Light to Dissolve

United Light & Power Co. has agreed to its own dissolution under the "death sentence" provision of the utility holding company act. H. B. Munsell, vice-president, told the SEC that dissolution of his company is the "most feasible and practical first step to simplify the system's corporate structure." United has chosen Kansas City Power & Light Co. as the nucleus of the integrated operating system.

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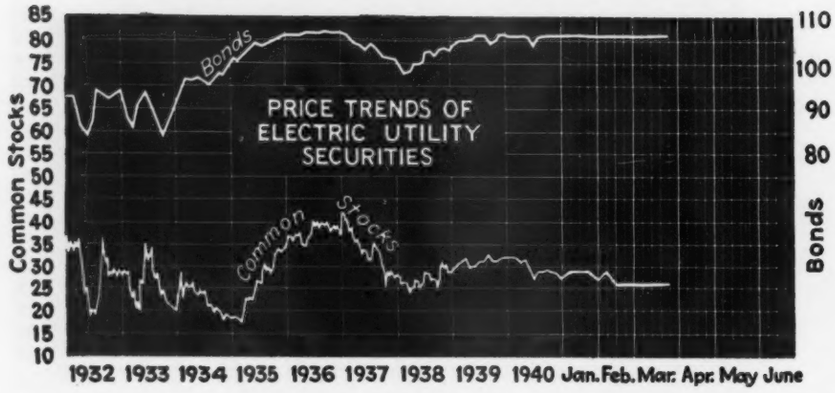
Refuse Sale of System

An unwillingness to sell out the Central New York Power Corp. facilities in Watertown has been expressed by power company representatives to city officials at an informal meeting. Although the view was stated that the utility wishes to remain in Watertown, officials admitted the right of the city to take over the property through condemnation.

Security Prices Show Slight Changes



Electric light and power securities drifted within a narrow range during the past week. "Electrical World" stock index turned downward to 25.9; last week, 26.0; last year, 30.7. The bond index advanced slightly—105.9; last week, 105.7

Financing Planned by Ohio Power

Ohio Power Co. has filed with the Securities and Exchange Commission an application covering $15,000,000 of first mortgage bonds due in 1971 and 202,403 shares of cumulative preferred stock of $100 par value.

The company proposes to offer 169,403 shares of the preferred stock to the holders, other than the American Gas & Electric Co., of outstanding preferred stock on a share-for-share basis plus cash equal to the difference between the redemption price of the outstanding preferred and the initial public offering price of the new preferred. The bonds, the remaining 33,000 shares of the preferred stock and shares not taken under the exchange offer will be offered publicly.

It was disclosed in connection with the financing that American Gas & Electric Co. would buy not more than 1,236,549 shares of common stock for $6,182,745 in cash and would make a capital contribution of $1,456,936 in cash.

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Note Issue Authorized

SEC has authorized the Durham Public Service Co. to issue an unsecured 2½ per cent note in the amount of $400,000, due September 1, 1943.

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Plans to Sell Holdings

United Corporation has filed an application with the SEC for approval of a proposal that it relinquish control of the voting stock of the Columbia Gas & Electric Corp., Niagara Hudson Power Corp., Public Service Corp. of New Jersey and the United Gas Improvement Co. If the plan is made effective, United will seek a declaration that it has ceased to have the status of a holding company.

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Standard Gas Reports on San Diego Exchange

Standard Gas & Electric Co. has announced that $6,304,850 principal amount of its notes and debentures had been exchanged for the common stock of the San Diego Gas & Electric Co. under the terms of the offer whereby Standard Gas had undertaken to reduce its funded debt through the exchange of 58 shares of San Diego common for each $1,000 principal amount of debt.

The plan of exchange, which was declared operative two months ago, has been extended until May 15, with the consent of the Securities and Exchange Commission.

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Plan to Dissolve Five Units Refused by SEC

SEC has rejected a plan under which Central U. S. Utilities Co., an indirect subsidiary of Associated Gas & Electric Co., would have disposed of the assets of five southwestern subsidiaries.

Central proposed to create a new subsidiary, Southland Public Service Co., to acquire assets of the five subsidiaries. The units then would have been dissolved.

SEC said it could not find the plan tended toward the economical and efficient development of an integrated utility system. The properties involved are: Arizona General Utilities Co., Arkansas General Utilities Co., Louisiana Public Utilities Co., Panhandle Public Service Co. and Texas General Utilities Co.

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Columbia Gas Files Debenture Issues

Columbia Gas & Electric Corp. has filed an application with the Securities and Exchange Commission regarding the issuance and sale of $92,000,000 of sinking fund debentures, due 1961, and $28,000,000 of serial debentures, due 1942-1951.

SEC announced the filing of a declaration regarding the acquisition by International Utilities Corp. of additional shares of common stock of its subsidiary, Dominion Gas & Electric Co., and the acquisition by the subsidiary of additional shares of common stock of its subsidiary, Northwestern Utilities, Limited.

Eastern Shore Public Service Co. of Delaware has filed a declaration regarding proposed advances, on open account bearing interest at the rate of 4 per cent, of not more than $300,000 to its subsidiaries as follows: Eastern Shore Public Service Co. of Maryland, $100,000; Maryland Light & Power Co., $75,000; Eastern Shore Public Service Co. of Virginia, $125,000. The advances are to be made to the subsidiaries from time to time as they need funds for construction purposes.

SEC has approved a reduction from 3 per cent to 2¼ per cent in the interest rate on Gulf States Utilities Co.'s $3,100,000 promissory note held by Chase National Bank, New York.

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Authorize Niagara Issue

New York Public Service Commission has authorized the Buffalo Niagara Electric Corp. to issue $7,200,000 of ten-year debentures at 2¼ per cent annual interest. The commission said $6,804,000 of the funds would be used for a construction program and the balance of $396,000 to retire a like amount of 5 per cent first mortgage bonds of Niagara Electric Service Corp., maturing in 1942.

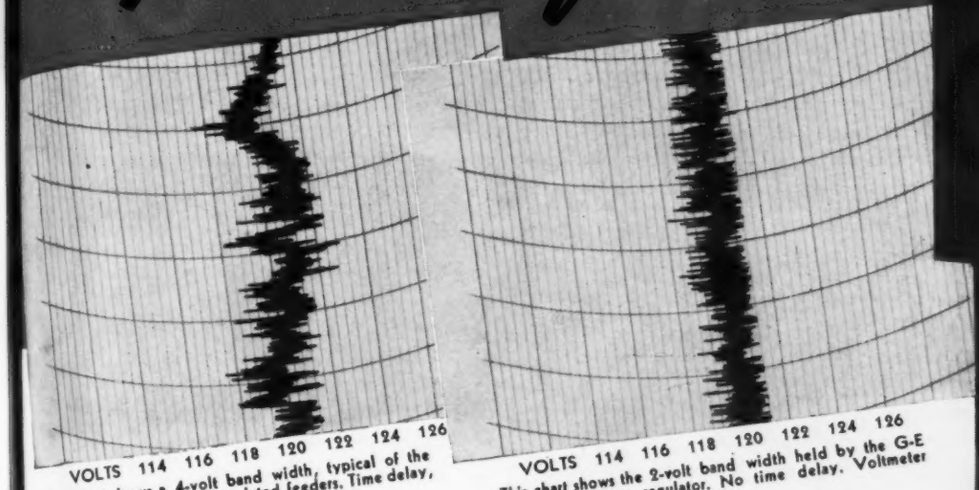
Utility Reports

	Net Income 1940	1939
*Boston Edison	$5,900,140	$5,466,890
*Brooklyn Edison	10,723,331	11,669,665
*Central Hudson Gas & Elec.	1,625,427	1,634,696
*Central Ohio Lt. & Pwr.	297,121	156,033
*Duke Power	5,997,101	5,619,767
*Duquesne Light	9,701,912†	10,262,723
*Fitchburg Gas & Elec.	345,389	341,574
*Florida Public Service	156,295†	271,639
*Indianapolis Pwr. & Lt.	3,204,926	2,210,813
*Niagara Falls Power	3,002,828	2,439,316
*Philadelphia Co. and subs.	6,230,978†	6,045,114
*Philadelphia Electric and subs.	22,115,629	22,595,521
*Pub. Serv. of No. Ill.	5,054,570	4,287,286

* Twelve months ended December 31.
† Preliminary.

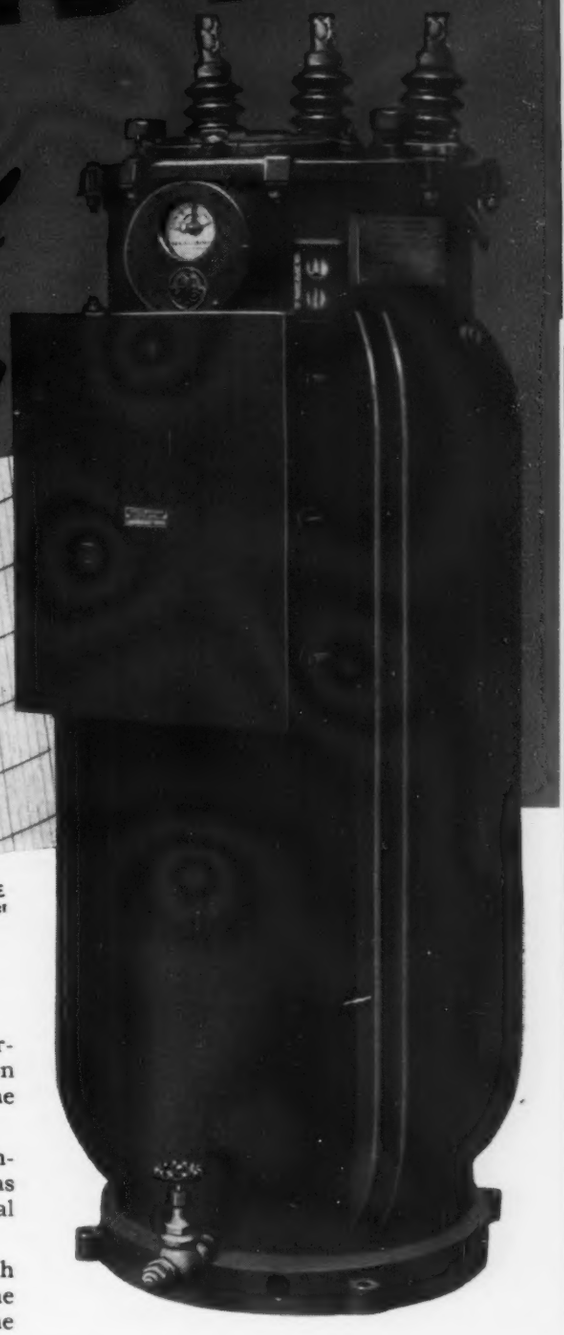
BAND WIDTH

The TRUE Measure of Regulator Performance



This chart shows a 4-volt band width, typical of the voltage bands on many regulated feeders. Time delay, 25 seconds; voltmeter setting, 2 volts

This chart shows the 2-volt band width held by the G-E induction voltage regulator. No time delay. Voltmeter setting, 2 volts



BAND width tells you how close a regulating device is holding a predetermined voltage level. Band width is the range of voltage actually held on each phase of a feeder by the regulating device, rather than the setting of the voltage regulating relay.

Today the G-E induction regulator, with its immediate response and high-accuracy control, gives the term "band width" new significance. Band widths can no longer be considered "about the same." There's a difference—a real difference. And it can be evaluated in dollars and cents.

Recent tests show that the G-E induction regulator cuts the usual band width in half by holding feeder voltages within a two-volt limit or less instead of the four-volt effective band held by feeder voltage regulators of other types. The difference—two volts or more—can be utilized *with profit* in any one of several ways, depending on feeder conditions:

1. It can be used to increase load-carrying capacity—by as much as 67 per cent.
2. It can be used to extend feeder length—by as much as 30 per cent.
3. It can be used to decrease revenue losses due to excessive voltage drops —$1,000 annually on a typical feeder.

Find out how much the narrower band width held by G-E induction regulators can mean on your feeders. Ask your G-E representative to show you on simplified charts what you can gain in terms of feeder length, load capacity, or reduced revenue losses. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

404-16-5400

OPERATING PRACTICES

Safeguarding CO_2 Use in Cable Manhole

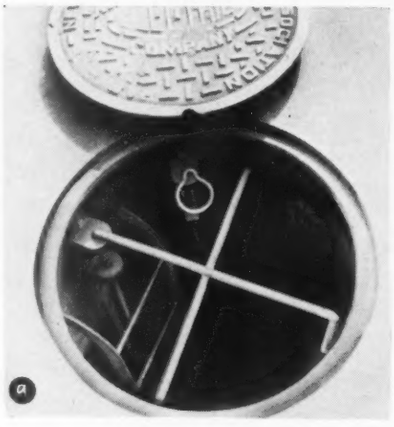
By J. J. O'BRIEN

Superintendent Underground Lines Narragansett Electric Company, Providence, R. I.

On the 110-kv. oil-filled cable line of the Narragansett Electric Company in Providence, R. I., are four stop-joint manholes equipped with a CO_2 gas installation for fire protection. Because of the amount of oil stored in the reservoirs it was considered desirable to install an automatically controlled fire-extinguishing system to minimize the effects of a possible cable joint failure with resultant fire. If one or more oil line connections from reservoirs to joints were broken, there would be a steady flow of oil to feed any flame that would be present.

In order to extinguish such a fire, a 55-lb. cylinder of CO_2 gas is installed in each stop-joint manhole. The release of the gas is accomplished in a fully automatic manner by means of two actuating relays located in the ceiling of the manhole. The relays are piped in parallel by means of fine-bore tubing to a master relay which releases a suspended weight. The dropping of the weight causes the seal on the CO_2 tank to be punctured, allowing the cylinder to empty through a system of piping and spray nozzles into the manhole space.

A safety device has been installed as a preventive against accidental discharge of the cylinder while men are in the manhole. A cross framework, one section of which slides up and down in a bearing support, prevents entrance through the manhole opening until the cross framework has been raised and rotated to the street level. In providing for such entrance a man inherently prevents the automatic operation of the CO_2 system because a non-corrosive flexible steel wire trained in guides is attached to the sliding member of the cross framework. The steel cable length is so adjusted that when the cross framework is raised to the street level a stop is placed against the suspended weight-piercing device, holding it suspended. In this manner the supply of gas is confined to the cylinder even though the actuating relays are subjected to an unusual rate of temperature rise as might occur if a blow torch or portable lamp used by men working in the manhole should be brought into close proximity with the actuating relays.



CROSS FRAME in normal position below cover opening prevents entrance into manhole while CO_2 equipment is set for discharge (a). When cross frame is lifted and swung outside manhole, freeing opening for entrance, no CO_2 discharge can take place (b)

The system can also be operated from the street level by an independent non-corrosive steel cable connection. This permits the weight to be dropped by pulling the ring attached to the steel cable in the manhole opening, thus causing a manual tripping of the automatic releasing device or master relay, as it has been called previously. To do this it is necessary that the steel cross framework be in its proper position, blocking the manhole opening. If the framework is at the street level this manual system is inoperative.

It is believed that this system is completely effective both from the fire protection and safety angles.

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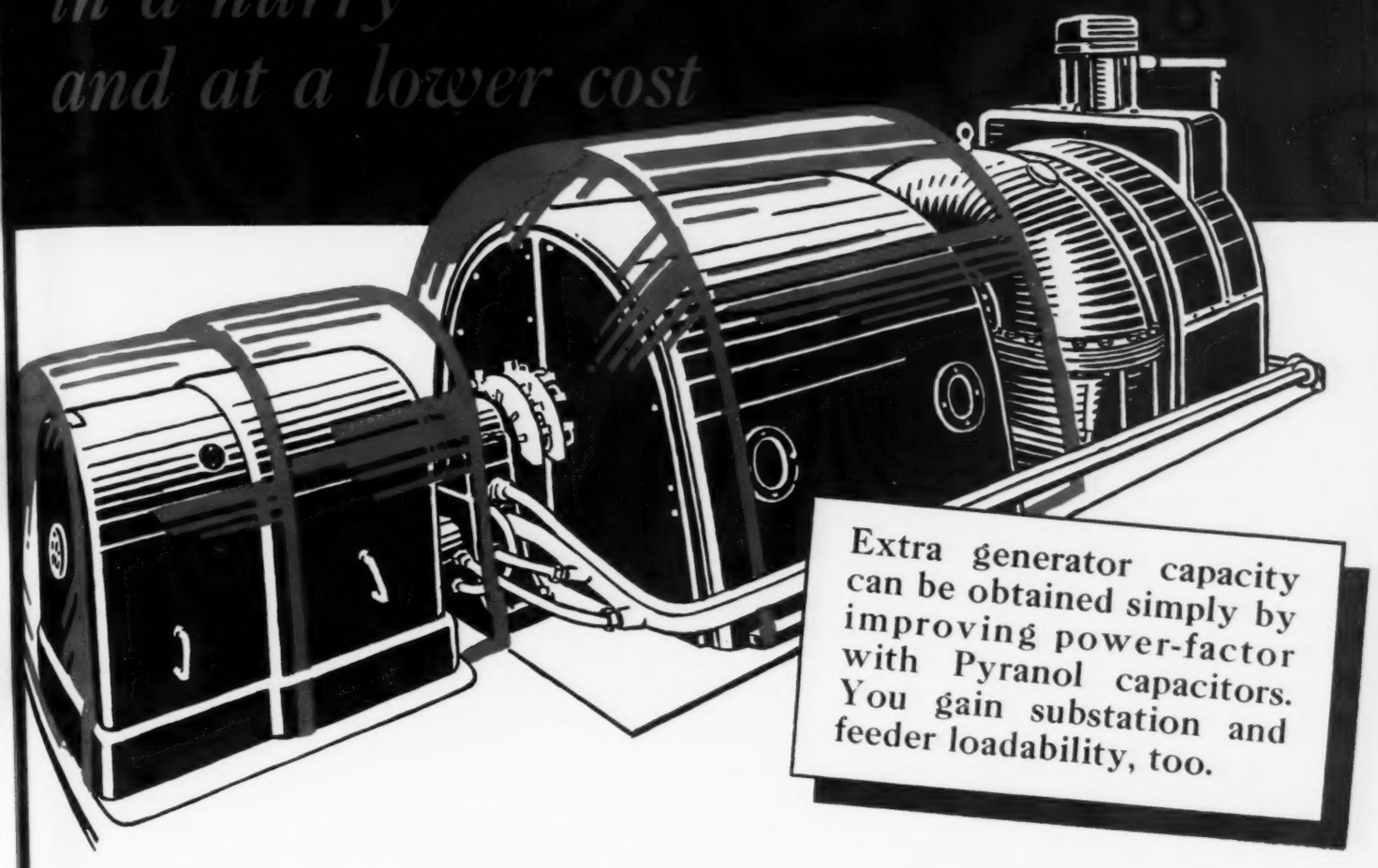
Switching Station Layout Simplified

In an outdoor switching layout providing important service to a number of industrial plants on defense order work, among others, provision has been made for superseding the original 13-kv. line arrangement (a) with a simpler and more symmetrical set-up (b), in the interest of more uniform service and logical disposition of circuits and associated air-breaks. In the original set-up only five hand-operated air-breaks were provided, with selector knife switch in one circuit serving an important factory (No. 1) and reliance upon fusing for a second circuit to the same factory. The absence of a sixth air-break switch in one of the incoming lines left the conditions relatively

Just Like Installing a Bigger Generator—

in a hurry—
and at a lower cost

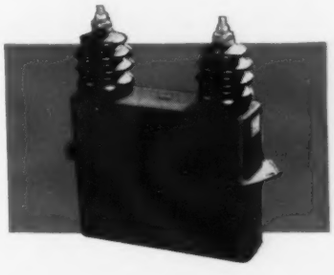


Extra generator capacity can be obtained simply by improving power-factor with Pyranol capacitors. You gain substation and feeder loadability, too.

"SEVEN HUNDRED kva of generator capacity released by installing 1550 kva of Pyranol capacitors," reports a Michigan power company. And this *in addition* to a 10 to 30 per cent increase in substation loadability plus a big boost in feeder capacity.

That's why Pyranol capacitors are such a time- and money-saving investment. They reflect their capacity-boosting benefits from the point of application *clear back to the generator,* and so make room for more load all along the line.

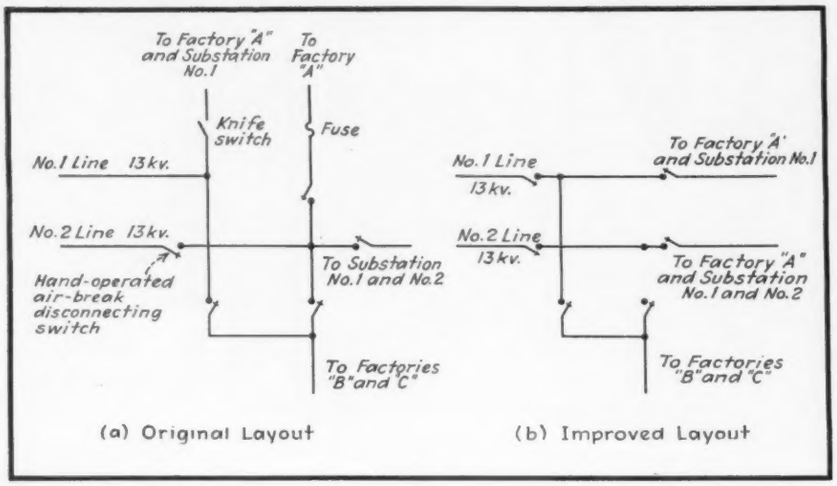
They're easy to install, too. Just hang them on the poles and make connections. Equally important, they're easy to relocate when load conditions change. And deliveries are prompt—most standard ratings are shipped *right off the shelf.*



You're missing a good bet if you don't investigate Pyranol capacitors. They're a quick, low-cost answer to the problem of today's fast-growing loads. Call your G-E representative now for a preliminary estimate of the capacity increase that's possible with Pyranol capacitors—or write for Catalog GEA-3333. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

407-19-5700



ORIGINAL LAYOUT did not grade service equally (a). Improved layout provides symmetrical, uniform facilities (b)

inflexible, despite the hook-up insuring relay service to all three factories, "A," "B" and "C," from a second line in case the first went out of service.

The improved arrangement rounds out the scheme of supply by providing for a hand-operated air-break switch in each incoming line; one in each circuit feeding factory "A" and one in each tap feeding factories "B" and "C" by a single circuit leading from the through lines as shown. In case the loads increase sufficiently in factories "B" and "C," a second circuit can be added, merely extending the industrial taps in parallel lines. With the improved layout all equipment is uniformly laid out and sectionalizing is complete, facilitating inspection and maintenance. Isolation of trouble is satisfactorily provided for over an extended industrial plant neighborhood.

Sectional Caisson Speeds Pole Setting

An improved-type cylindrical caisson consisting of sections which are free to slide with respect to one another so that they may be lowered alternately as excavation progresses is being used by Northern States Power Company, Eau Claire, Wis., to save time in excavating pole holes in gravelly ground and quicksand. The ease with which the individual sections of the caisson may be fitted together in the excavation and removed after the pole has been set contributes to its other time-saving features.

The caisson used by this utility for pole setting is cylindrical in shape, 24 in. in diameter and approximately 5 ft. long and is divided longitudinally into two semi-cylindrical sections with substantially watertight tongue and groove type connections between sections.

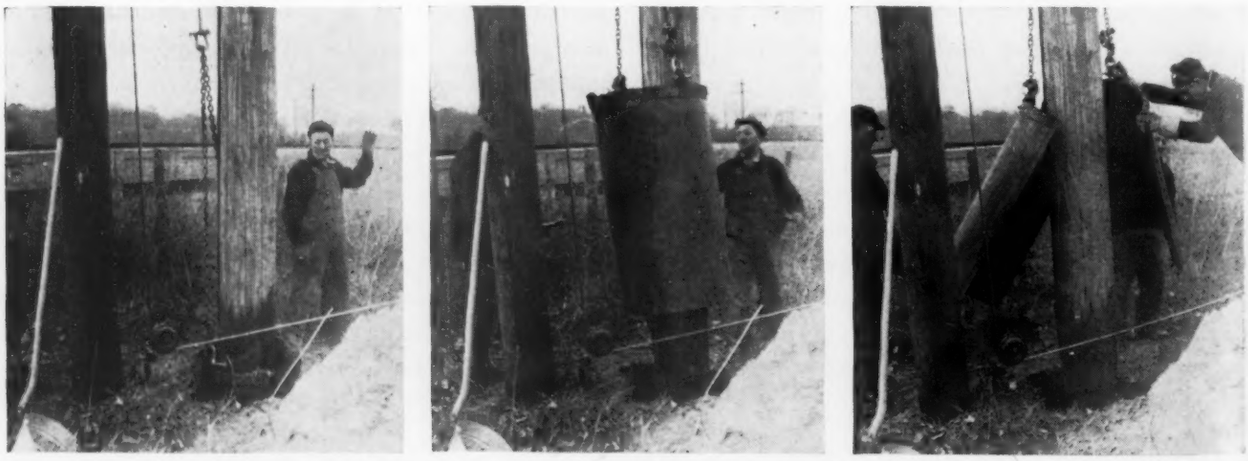
In use the sections may be either wired together and the caisson lowered into the excavation as a complete cylinder or the sections may be assembled in the excavation with the vertical tongue and groove connections engaged but wires omitted. Without the wires the two semi-cylinders can be lowered alternately as excavation progresses and the sections withdrawn separately after digging is completed and the pole has been set inside the caisson.

The tongue and groove connections form a substantially watertight connection, preventing seepage of water into the excavation. The sectional caisson is covered by patents held by employees of the utility company.

•

Phase Marker Plates Found Useful Devices

Specifications of the Central Maine Power Company for phase marker plates include: (1) Inscription side of plates shall be lettered as follows: Phase No. 1—Background, red baked enamel; figure 1, white enamel. Phase No. 2—Background, white baked enamel; figure 2, black baked enamel. Phase No. 3—Background, blue baked enamel; figure 3, white baked enamel. (2) Four holes shall be punched in plate before enameling for non-corrosive eyelets, made for ¼-in. bolts, located as shown. (3) Plates to be of 18-gage genuine "Armco" ingot iron, with colors of baked



TWO-PART cylindrical caisson used for excavating pole holes in loose gravel or quicksand
Left—Winch pulls caisson from hole after pole has been set. Lashings are removed (center) and caisson separates (right) into two semi-cylindrical sections for easy handling

IS STRONG ON PROTECTION

Extra Protection
AGAINST PHYSICAL DAMAGE

A truly modern motor, you told us, must be able to withstand accidental blows, flying chips, dripping liquids, and occasional bumps in moving or mounting. That's how we built the Tri-Clad motor!

We made the frame and end shields of cast iron; used channel and rib sections to give ample strength where needed, without increasing the weight; cast the feet integrally with the frame to make them sturdy and rigid. We completely enclosed the upper portion and carefully baffled all ventilating openings to protect vital motor parts. We provided the bearings with cast-iron housings and made them dust tight. And the finishing touch—we give the motor a tough coat of paint that protects the metal parts against rust and corrosion.

The Tri-Clad motor is fully protected against the accidental ill-treatment some motors encounter all the time, and which *all* motors encounter some of the time. As a safeguard against production interruptions, as a prime factor in lowering costs, as an extra increment of value on machines you build, you'll find that this new motor means extra profit protection, too.

Be sure your next induction motors are Tri-Clad. General Electric, Schenectady, N. Y.

Extra Protection

AGAINST ELECTRICAL BREAKDOWN

New stator windings of Formex wire give extra protection internally against moisture, oil, abrasion, and heat aging. New synthetic impregnating and protecting varnishes make a rigid unit with a hard finish.

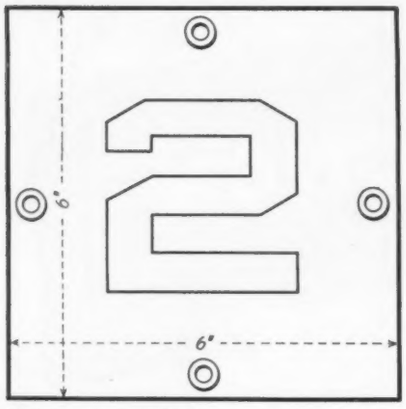
Extra Protection

AGAINST OPERATING WEAR AND TEAR

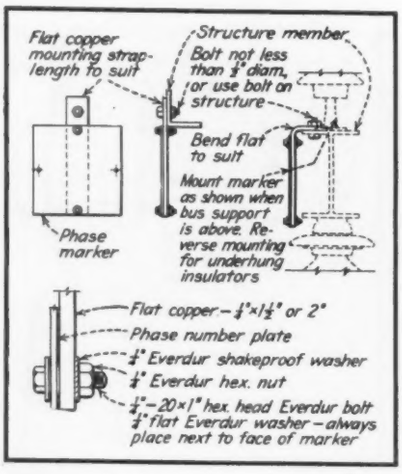
Sleeve bearings of new design have longer life and greater load capacity. The one-piece, cast-aluminum rotor winding, with fans cast integrally, is practically indestructible.

GENERAL ELECTRIC

TEO-42-8068



FACE OF PLATE for attachment to mountings


Flat copper mounting strap-length to suit
Structure member
Bolt not less than ¾" diam. or use bolt on structure
Bend flat to suit
Mount marker as shown when bus support is above. Reverse mounting for underhung insulators
Phase marker
Flat copper—¼"×1½" or 2"
Phase number plate
¼" Everdur shakeproof washer
¼" Everdur hex. nut
¼"—20×1" hex. head Everdur bolt
¼" flat Everdur washer—always place next to face of marker

DETAILS of mounting in association with phase designated

enamel guaranteed not to fade or tarnish for period of ten years.

Markers are located close to and in line with associated phases. Mounting details shown are merely suggestive and may be altered as desired or necessary. In mounting the plates, only copper flat and brass, Everdur or galvanized hardware is used; no black iron.

•

Phase-Load Data on Single Chart

By O. P. STICKNEY

Meter Engineer, Nebraska Power Company, Omaha, Neb.

Load-study data for each phase of a four-wire system can be secured on a single chart, regardless of load balance,* with a General Electric type "DG-1" demand meter and a 30-deg. auto-transformer by adding a switching device that will open or close the potential coil of one meter element at the end of each fifteen-minute interval.

The chart produced is clear and concise. A 24-hour period covers but six inches with a well-defined load curve. It lends itself very favorably to the study of power factor and by placing the three phase charts side by side a good picture of load balance is obtained. Thus the three essential factors for substation load analysis—load curve, power factor and load balance—may be quickly and easily ascertained.

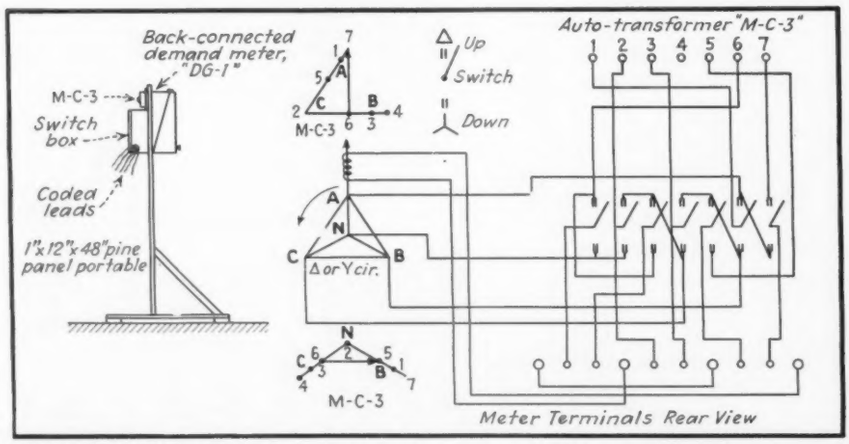
With the switching device actuating the top element, the meter has a bottom element always energized and a top element that is on for one fifteen-minute interval and off for the next, etc. If the current from the current transformer, located for example in "A" phase, is passed in series through the two elements of the meter, and by virtue of the auto-transformer a potential is obtained that is in phase with "A" and applied to the bottom element, and another potential that lags the first by 90 deg. is applied to the top element, the meter will produce a chart with alternate short and long lines.

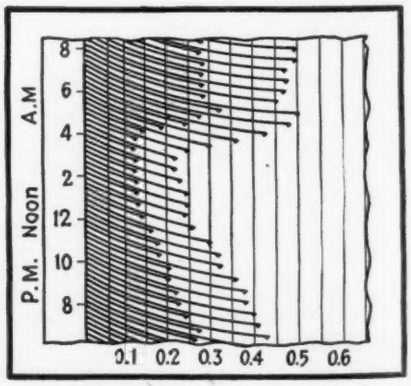
The short lines will be proportional in length to the kw. demand and the longer lines proportional to the kw. demand plus the kva.-r. demand. Since kw. can be represented by cosine θ, kva.-r. by sine θ, power factor by cosine θ and $\frac{\cos + \sin}{\cos} - 1 =$ tangent, then by substitution we have $\frac{\text{Long line}}{\text{Short line}} - 1 =$ tangent of an angle whose cosine equals power factor.

The switching device we are using consists of a fiber cam made in the shape of a cross with alternate short and long arms. A pin is mounted on the edge and at right angles to the gear wheel that meshes with the reset assembly. This wheel makes one revolution at the end of each time interval. The cam is so placed that this pin engages an arm of it and moves the cam one-quarter revolution, thus closing or opening a set of contacts, depending upon the position of the cam at the time.

The long arms only make or break the contacts.

* The errors encountered on a delta hookup will be less than 2 per cent for an unbalance of 10 per cent, and an error of 5 per cent for an unbalance of 25 per cent. These errors are additive or subtractive, depending on phase sequence.



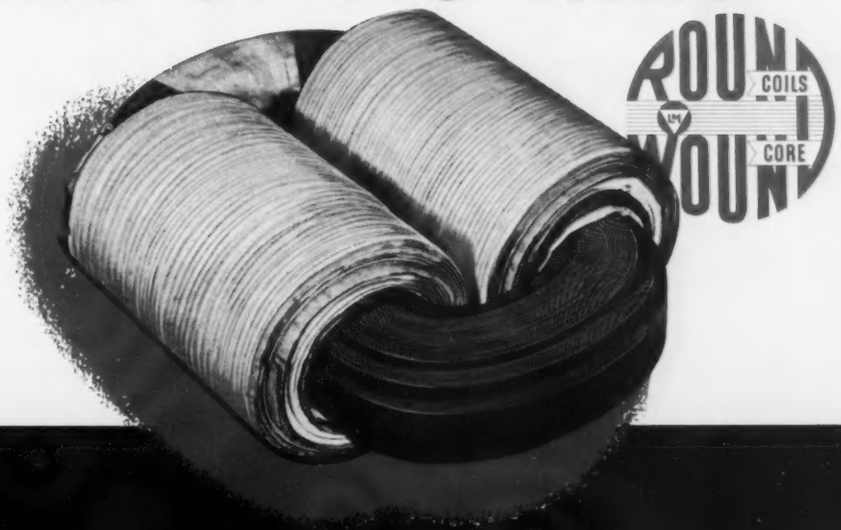


SWITCHING DEVICE, added to demand meter and 30-deg. auto-transformer, provides essential load-study data for each phase of four-wire system on single chart

Back-connected demand meter is mounted on one side of portable panel and test cabinet with meter trim on other side, with auto-transformer placed above cabinet, which houses instrument terminals, switches, etc. Code-wire leads are brought out through a federal bushing. On resultant modified load curve short lines are proportional to kw. demand, longer lines to demand plus kva.-r. Long line divided by adjacent short line minus one equals tangent of angle whose cosine equals power factor.

THE ONLY ONE OF ITS KIND

The L-M ROUND-WOUND is the only distribution transformer with a wound, cruciform core and two long, round coils . . .



It gives you:

1. **better regulation at all power factors**
2. **better ratio of losses**
3. **lower exciting current**
4. **uniformly high impulse strength**
5. **high short time overload capacity**

This development by L-M engineers is the first practical and successful production method of winding round coils directly onto a wound core, making possible the combination of these two ideal components of a distribution transformer.

Long, circular coils, the ideal shape of transformer coils, have lower reactance, uniformly high impulse strength, greater mechanical strength and improved time-temperature characteristics.

The wound, cruciform core, *undisturbed after annealing,* represents the closest approach to the ideal magnetic circuit yet obtained. It is uniform in its low losses and has uniformly lower exciting current.

The result is a transformer of outstanding performance characteristics.

The L-M ROUND-WOUND Transformer represents a basic improvement in transformer design well in advance of present day standards. The illustrated L-M ROUND-WOUND booklet offers you detailed information and convincing proofs of the claims made. Ask your L-M representative for it or write to Line Material Company, Milwaukee, Wisconsin.

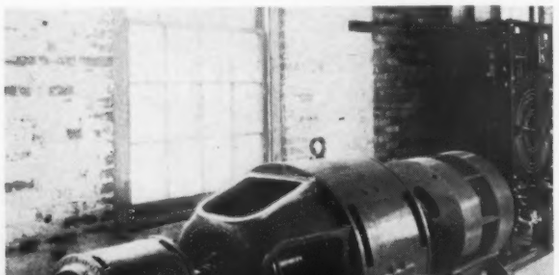
LINE MATERIAL COMPANY

INDUSTRIAL ENGINEERING

Paper Mill Drive Modernized

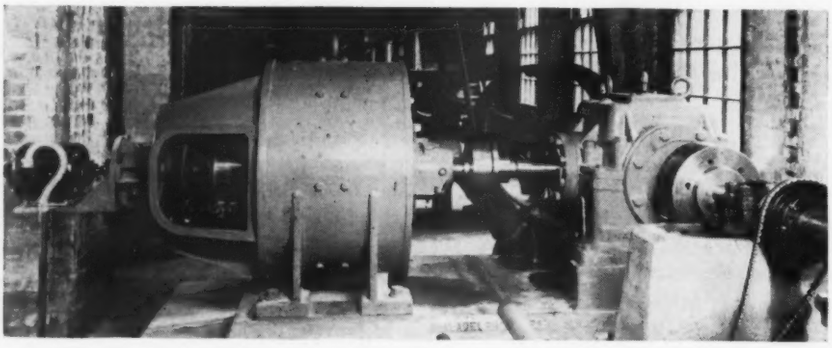
At the plant of the Parsons Paper Company, Holyoke, Mass., an improved drive of a Foudrinier paper machine has recently been installed, superseding an older method in which a constant-speed squirrel-cage induction motor drove the shaft of the Foudrinier through a hydraulic unit at one end of the machine. This machine handles a wide variety of papers and a wide range of speed control as well as close regulation of speed are required for quality production.

In the modernized installation a 550-volt, three-phase synchronous motor drives a d.c. generator on the same shaft, the latter supplying a 75-hp. d.c. motor which drives the Foudrinier through a speed reducer located at the center of the paper machine shaft, a superior arrangement mechanically over the former end drive. The new drive furnishes a speed range from 20 to 300 ft. per minute through the use of combined variable voltage and field weakening. Ample power is always available for heavy work at the lower speeds and the complete outfit is always under full automatic push-button control from the machine room floor above the basement where drive is located.



SYNCHRONOUS m.g. set and control panel provide flexible service

The new installation has proved more economical in the use of energy through the all-electric drive, insures more uniform production, and the power factor of the installation has been raised about 20 per cent. The drive incorporates an electric tachometer generator (chain driven from the Foudrinier shaft near the speed reducer, with indicating meter calibrated to read paper production speed in feet per minute. A pilot generator is also provided which works in conjunction with a voltage regulator to maintain close and automatic speed control at all times. The electrical drive was provided by the Crocker-Wheeler Electric Company, H. F. Giehler, master mechanic of the user, working in conjunction with H. E. Ballard of J. B. Woodruff, Holyoke consultant.



CENTER-MOUNTED variable-speed drive of paper machine has range of from 20 to 300 ft. per minute

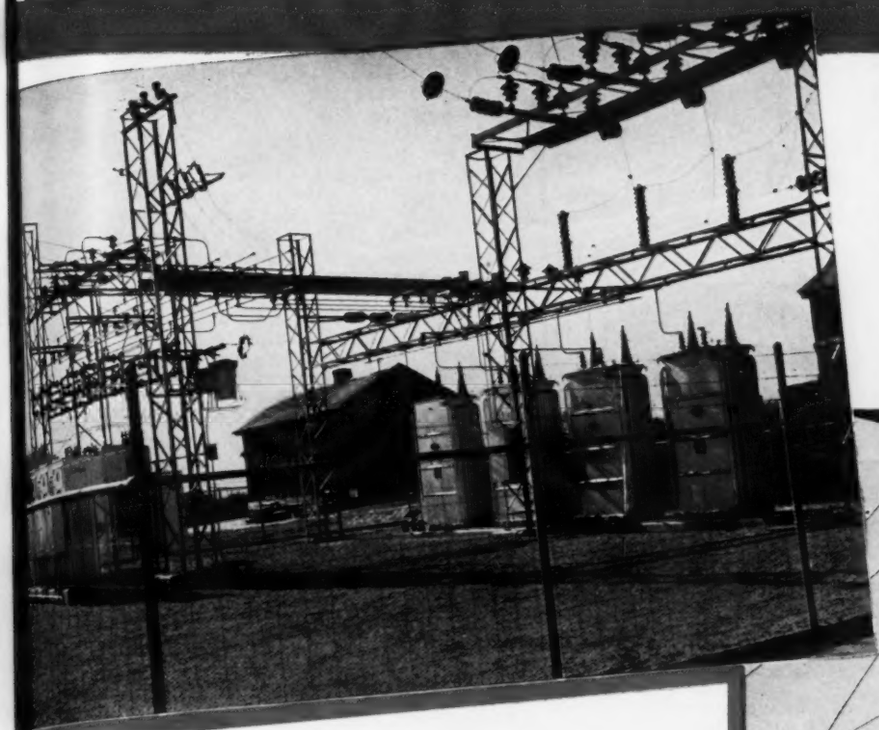
•

Proper Loading Improves Motor Drives

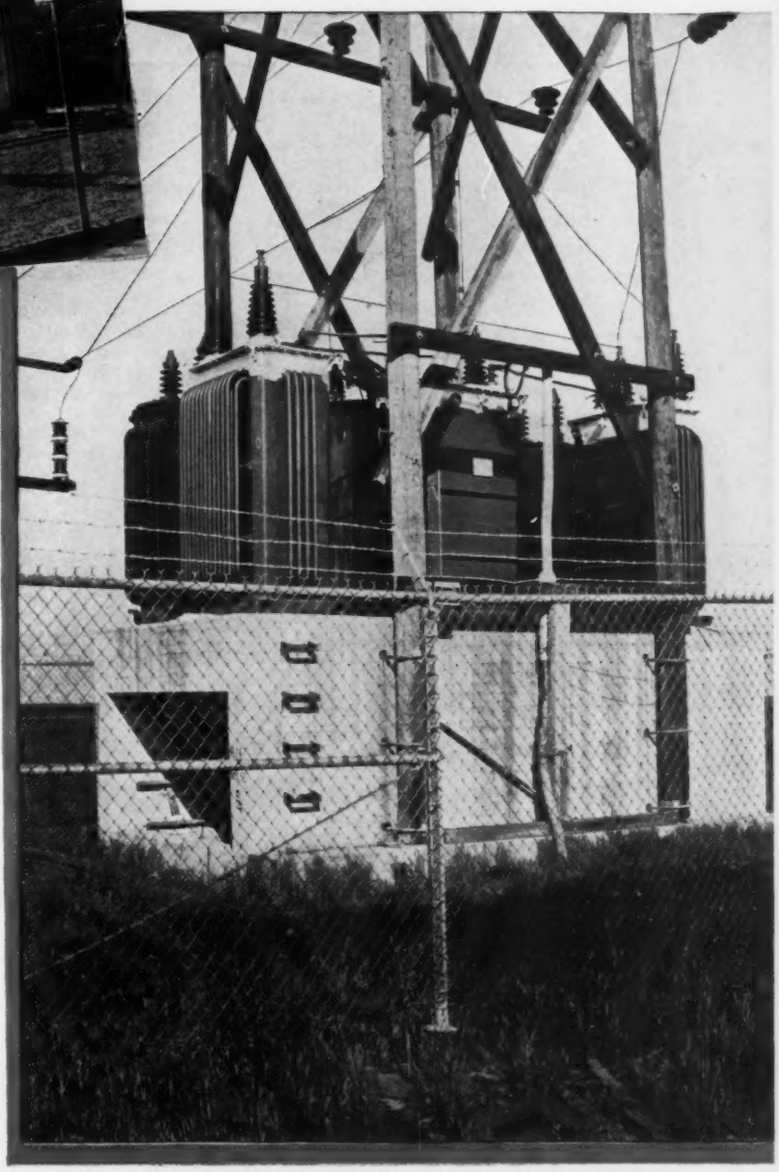
The value of surveys of motor-driving conditions in industrial plants is illustrated by the case of an Eastern factory active in the defense material production field. Tests were made of friction load, normal load and starting load where feasible. In cases of group drives, where possible the individual machine loads or normal group loads were taken. Friction loads included belting, gears and drive mechanisms; normal loads represented the usual conditions as presented by the shop foreman or machine operators. The objective was to determine the condition of electrical equipment (so vital in continuing production during the defense period); to ascertain the line of attack in improving economy of operation and raising the power factor, and to uncover and remedy unsafe conditions.

The majority of motors were found

WAGNER Distribution Transformers



Promote Continuity of Service



CONTINUOUS, uninterrupted service is a vital necessity in the power industry. Public confidence rests upon the ability of power companies to serve their customers 24 hours each day with absolute dependability.

The transformer is one of the vital links in any power distribution system. If the transformers give trouble, unsatisfactory service results and operating costs go up. The selection of transformers, since it affects both the consumer and power company, is a matter that should receive very careful study.

The actual performance record of Wagner transformers in service is your assurance that Wagner transformers will give years of continuous, uninterrupted service, and be a credit to your system. In all parts of the country Wagner transformers are establishing records for continuity of service.

The installation above is a job in the South. Wagner transformers were selected for this key position. The installation shown at the right is a replacement job. Here it was necessary to increase the capacity of the sub-station and Wagner transformers were the choice.

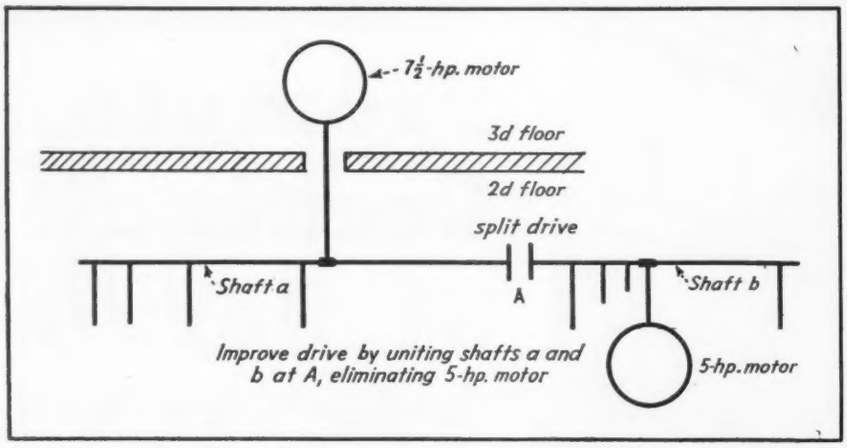
The engineering and construction features of Wagner transformers are the reasons why more and more companies are selecting Wagner. These features are fully discussed in Bulletins TU-180 (distribution) and TU-181 (power). Write for your copies today.

T40-5

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES



ELIMINATION of split drive releases 5-hp. motor and raises power factor

in good electrical condition with the exception of four aggregating 23.5 hp. which drew excessive magnetizing current attributed to loose rotor bars. In general, however, the motors were found to be seriously underloaded. Studies for rearrangement revealed that the power factor could be raised to about 80 per cent in this way and with the purchase of only one motor (a 1.5-hp. unit). Reduction of demand charge and billing was the reward of this solution, which involved the elimination of all excess shafting and pulleys. The maximum demand billed was 81 kw. and the power factor 69 per cent prior to the survey, the saving from rearrangement, etc., in one year being $150 in this item.

In analyzing the working conditions for the principal motors used, the following typical betterments were indicated as essential, omitting some of the data to save space:

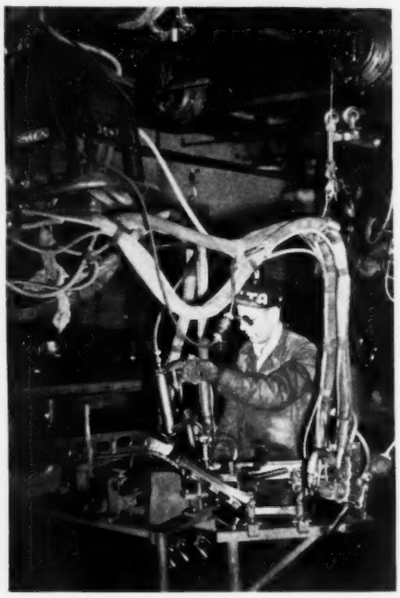
1. Remove 5-hp. motor from group drive shaft, uniting former split drive and operating machine group by 7.5-hp. motor. Former was run at 65 per cent of full load (power factor 63 per cent) and latter at 28 per cent load (power factor 53 per cent). Change raises power factor to 80 per cent, normally giving 7.5-hp. motor 75 per cent of full load and peak of only 6 per cent above rating. Speed changes readily made by pulley substitutions.
2. Replace 15-hp. by 10-hp. motor, doing away with excess shafting and pulleys.
3. Replace 15-hp. motor run at 46 per cent of load (72 per cent power factor) with 10-hp. motor, raising power factor from 72 to 80 per cent.
4. Repair phase winding which touches compensator case with lever in starting position, grounding case to water pipe.
5. Replace 5-hp. motor running at 22 per cent load and 31 per cent power factor with 1.5-hp. motor of wound rotor type to reduce starting current and raise power factor to 80 per cent.
6. Eliminate excess shafting and pulleys on 10-hp. motor running at 27 per cent rating, replacing with 3-hp. motor. Power factor to rise from 35 per cent to close to 80.
7. Replace 10-hp. motor driving group of fifteen machines with 5-hp. motor, as the motor was only half loaded with ten machines in use. Power factor gain, 43 to 80 per cent.
8. Plan to replace 15-hp. induction motor running at 90 per cent rating (80 per cent power factor) with 15-hp. synchronous motor for blower drive (100 per cent power factor).
9. Replace 5-hp. elevator motor with available 15-hp. motor to reduce starting current and avoid overload. Short periods of operation justify underloading the larger motor.

•

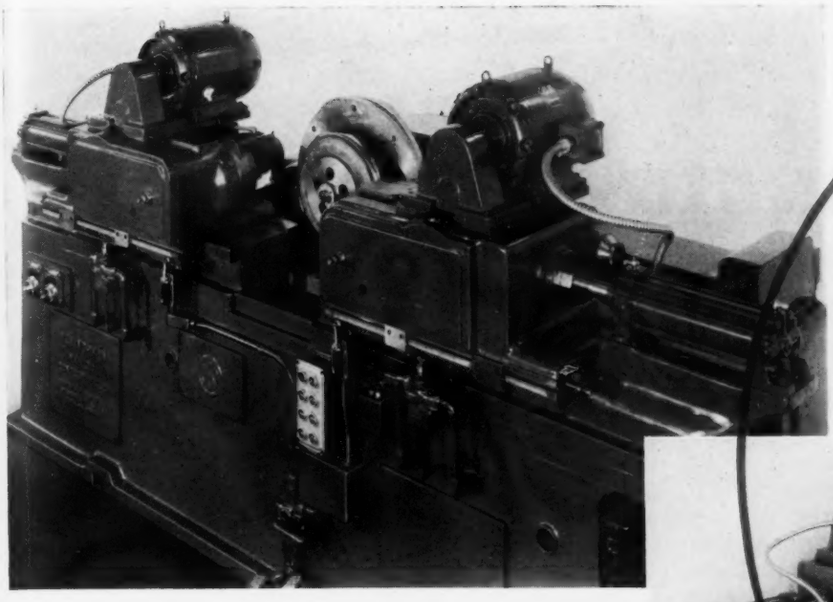
Fluorescents Light Airplane Plant

Cessna Aircraft Company's new Wichita, Kan., plant is lighted, as shown, with more than 400 RLM-type fluorescent fixtures, each housing three 40-watt, 48-in. lamps. Fixtures are mounted 18 ft. above the floor and are on 14-ft. centers. Estimated general illumination is 15 foot-candles 30 in. from the floor

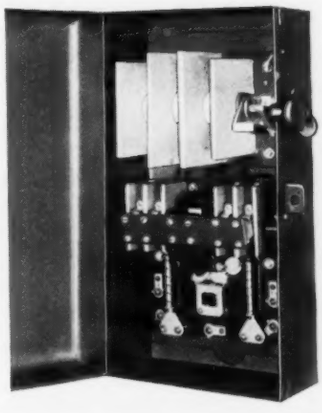
One Transformer for Two Welding Guns



In the production welding of front pillars and cowl sides for Nash automobile bodies the Seaman body division of Nash-Kelvinator Corporation, Milwaukee, uses two spot-welding guns on a single 50-kva. welding transformer. While two guns are never used simultaneously, it was found easier for the operator to use two guns of different throat shape than to try to handle a single gun in an awkward and tiring position. By connecting both guns to the same transformer it was possible to save the cost of separate timing, transforming and welding contactor equipment without imposing too severe duty on it. The operator is shown here using one of the guns while the other hangs idle at the right.



Precise Control for a Precision Machine . . . . .



A typical 6335KA2 combination across-the-line and disconnect Monitor starter.

WHEN designing a Contour Milling Machine for aircraft engine parts you've got to think "a long way back of the decimal point" to arrive at the hair-splitting accuracy required of its work . . . The Van Norman No. 10 CT, illustrated above, is a beautiful example of just such a machine — tool room precision plus high productive capacity.

It is only natural, then, that for the safety and efficient operation of this tool the designers would specify automatic controls of equal precision and dependability . . . Look for the name plate on the controller box and you'll find the answer—*Monitor*.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

NEW ENGINEERING IDEAS

Relay Causes Delay From 5 to 40 Cycles

By C. T. ALTFATHER
Relay Engineer Westinghouse Electric & Manufacturing Company, Newark

Delays, commonly scorned, are not always undesirable. In fact, on a recent relay application two quite different problems arose almost simultaneously, calling for some relaying scheme that would impose a definite time delay of about a half second. One of the problems occurred in connection with the application of ratio differential relays to protect a central station bus against ground faults. This type of relay was applied instead of the conventional ground relays, because it provided protection against simultaneous ground faults. Although it served the purpose excellently false operation due to direct-current transients was possible. Interposing a delay of about 40 cycles would correct this condition.

Rectifier Problem

On the same system there was a mercury-arc rectifier supplying power to a transit system. It was desirable to be sure that, following either a fault or intended de-energization of the rectifier, the alternating-current breaker be opened ahead of the direct-current breaker.

A time delay of a half second is too long when obtained by standard auxiliary relays and too short for direct-current motor devices. Synchronous-motor arrangements were not acceptable because the alternating-current supply is not always reliable when relay operation is required. The use of copper rings around the relay magnets to slow up relay action is successful only on the de-energizing stroke. Some new relay trick was obviously demanded.

This new relay resembles an induction-type relay. When the relay is energized, a small direct-current electromagnet stores energy in a spring which tries to close the relay contacts carried on a timing disk. Immediate closure is prevented by the damping action of permanent magnets on the timing disk. By adjusting the position of the damping magnets or the distance of travel of the contacts, or both, any time delay from five to about 40 cycles is obtainable.

By increasing the strength of the damping magnets and using a damping disk of different material, the maximum time delay can be increased to about five seconds. The minimum delay will be increased in approximately the same ratio. A further change in the mechanical connection between the electromagnet and the damping disk makes possible a maximum delay of 30 seconds. In this latter mechanism a ratchet is employed so that the time delay is obtained in one direction of travel only. It is possible to have the delay either when the relay is energized or when it is de-energized.

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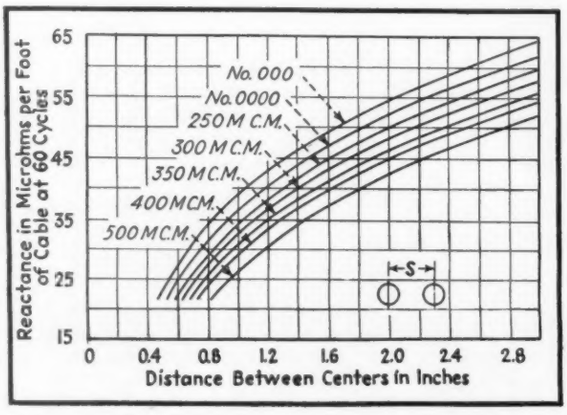
Reactance Chart Solves Welder Bus Problem-II

By R. C. BOUSE and J. D. SCARBROUGH
Detroit Edison Company

In a former article (ELECTRICAL WORLD, March 8, 1941) the necessity of keeping the reactances of the plant supply low if reasonably good voltage regulation is to be maintained was cited. A simple method, utilizing charts of reactance for a pair of conductors, was discussed and an example for strap conductors given.

This same method can be used on stranded cables, except that the reactance values are taken from another chart.

Numerical Example — Determine the reactance of six—250,000-circ.-mil interlaced standard strand, rubber-insulated cables 1,000 ft. long and arranged in two parallel rows with 1+, 4−, 2+ and 5−, 3+, 6−. The copper diameter is 0.576 in., the rubber thickness is 0.094 in. and the braid thickness is 0.020 in. giving a total diameter of 0.804 in. The distance between the centerlines of each conductor and all of the other conductors



REACTANCE of standard strand cables at 60 cycles. For total circuit reactance (going + return) multiply by two

should be calculated and the corresponding reactances should be obtained from the chart.

The distance between the centerlines of conductors 1 and 3 is $\sqrt{0.804 \text{ in.} + 0.804 \text{ in.}} = 1.138$ in. and the corresponding reactance is 0.0368 ohm per 1,000 ft. The remaining reactances can be found in a similar manner.

$$X_1 = 0.0288 + 0.0288 + 0.0473 - 0.0448 - 0.0368 = 0.0233$$

$$X_2 = 0.0288 + 0.0473 + 0.0288 - 0.0448 - 0.0368 = 0.0233$$

$$X_3 = 0.0288 + 0.0288 + 0.0288 - 0.0368 - 0.0368 = 0.0128$$

$$X_T = \frac{2}{9}(X_1 + X_2 + X_3) = \frac{2}{9}(0.0233 + 0.0233 + 0.0128) = 0.0132 \text{ ohm (going and return)}$$

The reactance of concentric tubular buses is easily expressible in a formula. Let the outer radius of the outer tube be r_4, the inner radius of the outer tube be r_3, the outer radius of the inner tube be r_2 and the inner radius of the inner tube be r_1. The reactance X can then be expressed as

$$11.49\left[4.606\left(\log_{10}\frac{r_3}{r_2} + \frac{r_1^4}{(r_2^2 - r_1^2)^2}\log_{10}\frac{r_2}{r_1} + \frac{r_4^4}{(r_4^2 - r_3^2)^2}\log\frac{r_4}{r_3} - \frac{r_2^2 - r_1^2}{2(r_2^2 - r_1^2)} - \frac{r_4^2 + r_3^2}{2(r_4^2 - r_1^2)}\right]\right] \times 10^{-3}$$

Where X is in ohms per 1,000 feet of bus. (Total going and return circuit.)

•

Photo-Tube Charts Motor Revolutions

By W. S. WEIL
General Electric Company

A photo-electric motor revolution recorder has proved useful in the development and testing of motor-driven mechanisms of various types. With it tests have been made at speeds of over 12,000 r.p.m. and at accelerations and decelerations greater than 180,000 r.p.m. per second, where a shaft rotating at 3,000 r.p.m. is brought to a stop by a mechanical brake in one cycle.

Accurately recording the instantaneous positions of a non-uniformly rotating shaft is difficult with mechanical devices, particularly at high speeds, since a device that makes and breaks contacts throughout each revolution to give a step-by-step indication of the revolving shaft is subject to dead spots, as well as skip and bounce. To overcome these difficulties the photo-electric recorder was developed; it provides a current output that can be recorded on an oscillographic film.

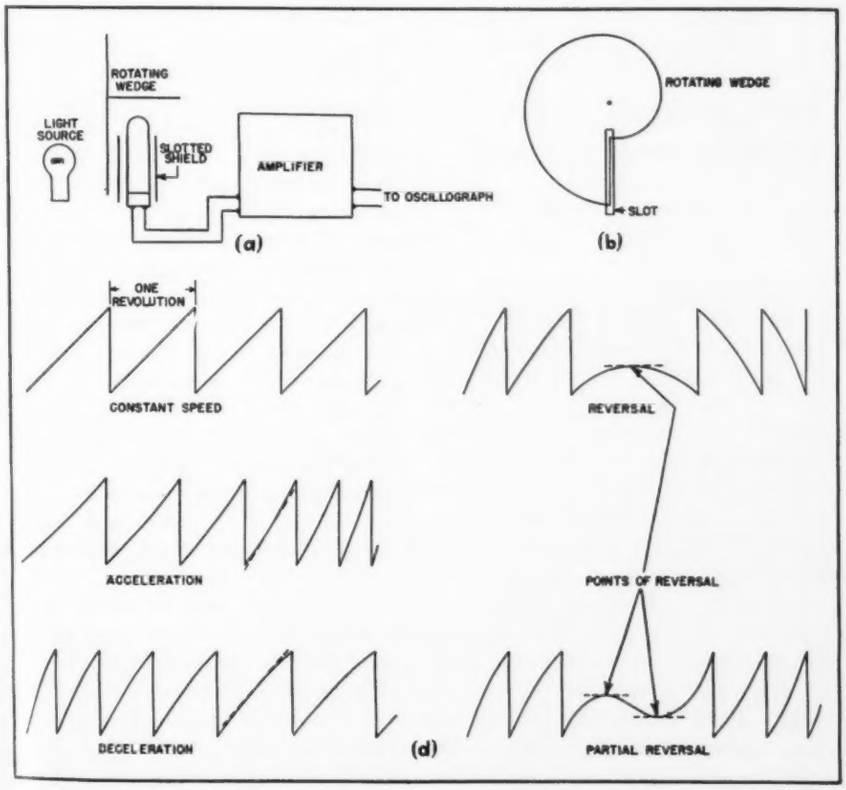
The photo-tube used in this recorder is placed facing the light source, but is so shielded that the only light falling on its senstitive cathode is a narrow vertical line. A spiral wedge, driven from the shaft under observation, is introduced between the light source and the slotted shield so that, as the shaft is rotated through 360 deg., the amount of light falling through the slit on the photo-tube is increased uniformly from a minimum to a maximum value. At the end of the complete revolution the amount of light falling on the photo-tube is suddenly decreased to the initial minimum value.

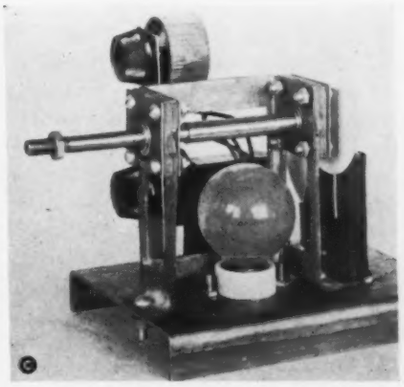
Amplify Current Output

Since the output of the photo-tube is proportional to the amount of light falling on it the current will have the same variations as those introduced by the rotating wedge. Since the output of the photo-tube is not sufficient to operate an oscillograph element a single stage of vacuum-tube amplification is incorporated in the apparatus.

The device can be applied to recording straight-line motion simply by means of a pulley on the shaft and by operating the pulley drive from the motion to be recorded. The diameter of the pulley should be made such that the shaft will have some definite angular motion for the full rectilinear stroke.

Complete recorder and a typical oscillographic record obtained under various conditions of operation are shown in accompanying illustrations.



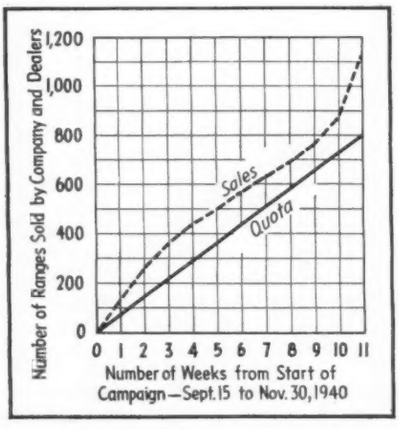


MOTOR REVOLUTION RECORDER makes use of a photo-tube, rotating wedge and slotted shield (a), (b) and (c), to give oscillographic record of instantaneous position of rotating shaft. In the typical record (d) one revolution occurs between each peak and acceleration and deceleration are shown by the concavity of the record as well as by the changing distance between peaks

LOAD BUILDING

Sell 1,130 Ranges in Eleven Weeks

Vigorous cultivation of the New Haven-Bridgeport territory in Connecticut by the United Illuminating Company and 71 co-operating dealers in the eleven weeks between September 15 and November 30 resulted in the sale of 1,130 electric ranges, a record of fall merchandising activity in domestic load building for that particular area. Starting with a quota of 800 ranges, sales leaped ahead of the bogy the first week and continued in that way through the entire period. During the last week 250 ranges were marketed and on the final day one salesman booked eight units. The basis of the campaign was free range wiring, under which the United company for a standard installation paid the cost of changing the customer's service entrance besides installing and connecting the range.



QUOTA exceeded 41 per cent in intensive electric range campaign

Six public electric cooking demonstrations featured the campaign, five being held in New Haven and one in Bridgeport. About 1,500 persons attended. The average selling price was in excess of $150, and only 1 per cent of the sales were in the $99 (minimum) class. Many employees of the company took advantage of the free wiring offer. Every United salesman made his quota and the Bridgeport district won the maximum number of sales. Dealers sold about half the total.

These range sales represent a total sales volume of about $175,000, yielding an estimated annual energy consumption of 1,500,000 kw.-hr., an added load of 1,200 kw. and an estimated yearly revenue of $30,000 to the utility.

•

Programmed Light for Machinery Plant

By J. V. DEMPSEY
Power Sales Engineer Central Vermont Public Service Corporation, Claremont, N. H.

Under present conditions in the machine tool industry everything possible is being done to expedite production and speed deliveries required in manufacturing processes vital to defense. In addition to necessary plant, machine tool makers appreciate the great importance of adequate lighting in relation to increased production and have given widespread attention during the past year to this aid to preparedness. Such work has extended all the way from drafting rooms to shipping departments, and in many cases has proceeded on a step-by-step development in which the benefits of better lighting have contributed to each forward move in plant modernization.

A typical instance of complete plant "light conditioning" is afforded by the Bryant Chucking Grinder Co., Springfield, Vt. The original building of the plant was a monitor type wooden shop about 143 x 230 ft. in plan, with seven bays separated only by 8 x 8-in. vertical posts on 8-ft. centers, the bay widths and heights being varied and the inside entirely unpainted. With the provision of a drafting room adjacent to the office section occupying the front of the building, modern lighting was established to start the ball rolling. On advice of the local utility representative, Miller Duplexalite combination 250-watt mercury-vapor and 300-watt incandescent fixtures were installed in this new drafting room, providing about 35 foot-candles on the table through indirect lighting. Some 21 of these units were installed in a space 24 ft. wide x 80 ft. long x 14 ft. high. The units were installed in two rows on either side, about 3 ft. from inside and outside walls respectively, and to meet the requirements of a later third row of tables in the center a third row of lighting units can be provided to give even intensity over the entire area with fixtures on 8 x 9-ft. centers. For the initial two rows of tables the two rows of units provide ample intensity with enough "spill" to the center of the room satisfactorily to illuminate the files.

Extend Drafting Room Lighting

The drafting room lighting was so satisfactory that the same system was extended to the shop offices, with 24 units as above, painting the ceilings and side walls white for some distance down, from a dark walnut finish which had been carried through on the paneled ceiling and side walls.

With the construction of a new brick and steel addition to the plant

machines were transferred and relocated in the old shop. Bay by bay, the entire old shop was painted a mill white, and 300-watt "Glassteel" diffuser lighting units were installed throughout the low bays, using two rows of units per 14-ft. high bay on 8-ft. centers, to provide 35-ft. candles intensity on the working area. In the single high bay of the old shop (22 ft.) 750/1,000-watt Glassteel diffusers were installed in two rows on 14 x16-ft. centers, with a 16-ft. mounting height, using 750-watt lamps to deliver an average of 25 foot-candles on the work.

The new addition built upon the old shop section is of monitor type construction, 100 x 140 ft., with five bays. Four of these are 30 x 20 ft. Ceiling heights are 14 ft. for three bays and 20 ft. for the others. In the two higher bays two rows of concentrating type "Alzak" aluminum reflectors utilizing 750-watt tungsten lamps were installed on 12-ft. centers, ceiling mounted. In the low bays also, ceiling mounted, Glassteel diffusers using 500-watt tungsten lamps were employed, spaced as before. Another 100-ft. addition has recently been made, duplicating the foregoing installation.

•

Short Cut Calculation Of Water Heater Size

Quantity of hot water used for domestic service is an extremely variable factor which depends not only on the number of persons in the family served and on the number of baths that may be taken in a relatively short period of time, but also on such other factors as whether laundry work is done at home, number of servants employed, the amount of entertaining and whether overnight guests are to be provided for.

While there is no method by which the hot water requirements may be exactly determined in advance, a good general rule is that an average of 12–15 gal. of water at 140 to 145 deg. F. is required per person per day.

Going one step further, Indiana Service Corporation, Fort Wayne, has taken all the varying factors of service into account and evolved the accompanying table for its water heater salesmen and dealers, which represents a *minimum* standard of water heater sizes necessary to insure an adequate supply of hot water and satisfaction to users.

Minimum Storage Capacity in Gallons Required for Water Heaters for Combinations of Bedrooms, Bathrooms and Laundries

No. of Bedrooms in Use	Total Number of Bathrooms and Laundries						
	1	2	3	4	5	6	7
1	30	30					
2	30	40	50				
3	40	50	60	70			
4	50	60	70	80	90		
5	60	70	80	90	100	110	
6	70	80	90	100	110	120	130
7	80	90	100	110	120	130	140

If the manufacturer's capacity rating differs from the above figures, specify a heater corresponding to the nearest capacity recommended.

In using this table, if selection of the smaller size heater is indicated, consideration should be given to a larger size where laundry work is done in the home, or where there are other excessive demands for hot water. It is interesting to note that during the past two years very few 30- and 40-gal. sizes were sold, at least in Fort Wayne, where the 50-gal. size predominates for medium size homes.

Water temperature and thermostat settings on electric water heaters are as important to satisfactory water heater operation and life as size of the heater. Temperature of the water, as desired by the customer, is to some extent dependent upon the type of hot water service he has previously had. In order to secure a sufficient quantity of hot water from tanks that are too small, water is sometimes heated and stored at excessively high temperatures. This contributes to excessive formation of scale and to corrosive action on the metal tank. Longer life of the equipment is obtained if water temperatures are kept well below 160 deg. F. In electric water heaters, where adequate storage is provided, the modern trend is to keep the temperature of the water under 150 deg. F. as water at 140 to 145 deg. is entirely satisfactory for all average home uses.

•

Sixty Ft.-Candles for Jewelry Store

Effective use of down light from flush-type louvered fixtures in the ceiling, directly over jewelry display cases and in wall cases, marks the lighting treatment employed in relighting the Spenser Jewelry Company store, Dayton, Ohio.

This design was developed by lighting engineers at the Dayton Power & Light Company. Illumination intensity in the main sales floor, which is 86 ft. x 14 ft. x 12 ft. 6 in., averages 60 foot-candles and is secured with twenty 500-watt flush, louvered fixtures on 8½ x 7-ft. centers. Portion of the floor under the balcony, visible in the background, is lighted by five 200-watt fixtures of the semi-flush type on 8 x 7-ft. centers.

The eight wall display cases, three on one side and five on the other, are each lighted by fifteen 25-watt flush Pittsburgh reflectors, with five fixtures in each of the three sections of each case.

ENGINEERS of Dayton Power & Light design jewelry store lighting application to provide 60 ft.-candles

Certified★ FLEUR·O·LIERS

FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.
A Copy of This Certificate Should
E·T·L
Appear upon Each Unit or Package
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

The mark and symbol of a constructive service that assures the buyer of fluorescent lighting fixtures of getting high quality, trouble-free, efficient, balanced operation in using the new fluorescent lamps.

Certified Fleur-O-Lier Advertising Hits New High!

Twenty-six national trade and business publications will carry dominating FLEUR-O-LIER advertisements for April, May and June. FLEUR-O-LIER impresses on your customers these vitally important points:

1. Be sure that fluorescent lighting is properly installed so that you will have enough light to enjoy the full benefits from this efficient new light source.
2. Be sure to use Certified★ FLEUR-O-LIERS so that you will get balanced, efficient, certified equipment to do a reliable, satisfactory fluorescent lighting job.
3. All FLEUR-O-LIERS are *certified* by Electrical Testing Laboratories as meeting 50 rigid specifications set up by MAZDA Lamp Manufacturers for electrical, mechanical and illuminating excellence.
4. For best lighting results, be sure to get competent engineering advice, such as the local lighting company can offer, in planning the proper installation.

At the present time more than 75 different industrial and commercial designs—all Certified★ FLEUR-O-LIERS—are being offered to the users in a wide price range . . . and more are on the way.

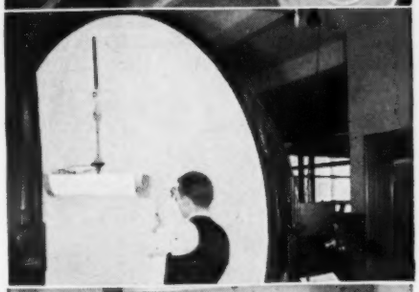
FLEUR-O-LIER MANUFACTURERS
Schedule of Advertising
APRIL, MAY AND JUNE, 1941

Hardware Age	April 3, May 15, June 12
Illumination	March
Lighting & Lamps	April
Purchasing	April, May, June
Mill & Factory	April, May, June
Nation's Business	April, May
Cotton	April, May, June
Super Market Merchandising	April, May, June
Electric Light & Power	April, May
Electrical Contracting	April, May, June
Architectural Forum	May, June
Chain Store Age (Adm. Ed.)	April, May
Drug Topics	April 7, May 5
Buildings & Bldg. Mgnt.	April, May
Iron Age	April 3, May 1
Men's Wear	April 23, May 21
Progressive Grocer	May, June
Business Week	April 5, May 3, June 7
American Machinist	April 2, May 14, June 11
American Hairdresser	May, June
Electrical World	April 19, May 17
Electrified Industry	April, May
Wholesaler's Salesman	April, May, June
Steel	April 7, May 5
Industrial Equipment News	April, May, June
Building Reporter	April, May, June

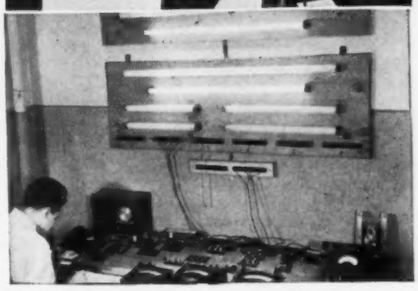
OVER 40 LEADING FIXTURE MANUFACTURERS PARTICIPATE IN THE FLEUR-O-LIER PROGRAM

..key to the best in fluorescent!

General inspection of fluorescent unit. The body of the luminaire must pass many requirements of physical strength, electrical safety, etc., in addition to the illuminating requirements.



Measuring efficiency of utilization of light, using the 100-inch photometric sphere. This measurement gives the percentage of the light given off by the lamps alone compared with the light produced when all reflectors and accessories are in place.



Checking performance of fluorescent lamp ballasts. The ballast under test is operated in comparison with a standard ballast, and must operate within prescribed limits.

3 of the 50 rigid specifications tests.

Certified auxiliary control equipment assures balanced, coordinated operation in every Certified FLEUR-O-LIER

All Certified FLEUR-O-LIERS are equipped with auxiliaries (ballasts and starters) *certified* by Electrical Testing Laboratories. Specifications include such important points as power factor correction, temperature control, elimination of radio interference and proper wiring.

Thus every complete FLEUR-O-LIER is certified for maximum lighting performance—safe, reliable service.

Four ways to get the most out of this program for the protection and advantage of your customers

- **Demand** the FLEUR-O-LIER certification label when you recommend or buy fluorescent lighting equipment.
- **Point out** the benefits and advantages represented by the FLEUR-O-LIER label to wholesalers and contractors in your territory.
- **Advertise** the FLEUR-O-LIER label in your local fluorescent advertising.
- **Write for** a free copy of this new booklet, "Fifty Standards for Satisfaction. Gives you details of the 50 famous specifications that make Certified★ FLEUR-O-LIERS the "key to the best in fluorescent." If you want this book in quantities for distribution to your representatives and contractors and distributors, you may secure them at 4c per copy —the cost price.

FLEUR-O-LIER
Manufacturers

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

TEAR OUT AND MAIL
Fleur-O-Lier Manufacturers • 2126-3 Keith Bldg., Cleveland, Ohio

Please send FREE, a copy of "50 Standards for Satisfaction," telling all about Certified FLEUR-O-LIERS.

Name _____

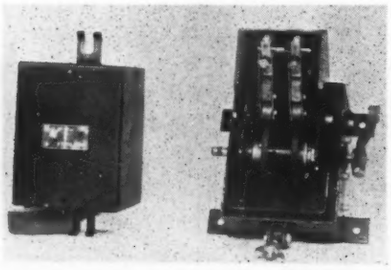
Address _____

City _____ State _____

NEW EQUIPMENT

Limit Switch

Cam-operated limit switch features "Micarta" fingerboard, on which two contacts are mounted, that swings upward out of the case for connecting, inspection and maintenance. Switch, designed especially for control circuits of such devices as hoists, industrial trucks, etc., may be actuated by either a revolving shaft coupled to its camshaft or by movement of operating lever attached to camshaft. Moving contacts are self-aligning.



"XC-23" cam limit switch; ratings of 2 amp. at 600 volts d.c. and 25 amp. at 110 volts a.c.; two contacts, either or both of which may be normally closed or normally open. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

•

Perspiration Protection

"Ply No. 9." **Milburn Co.**, Detroit, Mich.

Utilities, too, should find useful a colorless solution which is applied to the hands after washing, dries almost instantly and forms an invisible film that keeps perspiration in check. Use before slipping on rubber gloves is an application that suggests itself.

•

Welding Timer

Model "755" electronic tube-type timer; time selection range from 2 to 30 cycles; standard for 110-volt, 60-cycle operation with either magnetic or "Ignitron" tube contactor. **Weltronic Corp.**, Detroit, Mich.

Newest addition to this company's line of timers and controllers is an electronic welding timer which eliminates need for a pressure switch by allowing for a "squeeze" time interval in addition to "weld," "hold" and "off" time intervals. "Squeeze" time is interval between instant initial welding pressure is applied and welding current is "on," which is said to allow sufficient time to permit full welding pressure to build up before welding current is applied. Four adjustments are made by "dialing" the control knobs on front of panel. Single weld or automatic repeat operation is optional to suit the work.

•

Distribution Transformers

New line of distribution transformers is announced that accords with first report of joint E.E.I.-N.E.M.A. committee on standardization. Designed for direct pole-mounting, new transformers eliminate extra accessories, while standard bushings and hanger arrangements allow interchanging of all makes and ratings. Features include simplified hanger lug, standard location and size of grounding pad and bushings, simplification of voltage ratings and tap arrangements (tap changers supplied with all tapped transformers).

New standardized line of distribution transformers; from 1½ kva. to 25 kva., up to and including 15,000-volt class in standard voltages. **Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

Who Makes What?

"Electrical Buyers Reference," published annually. **Electrical World**, 330 West 42d St., New York, N. Y.

Names, addresses and products of electrical manufacturers are catalogued in this convenient, annual publication for public utility, industrial, engineering and other major electrical buying interests.

Street Lighting

Recent street-lighting developments of this company include a new luminaire for intersections, a pendent street light and a heat-insulating hood for street lights.

"Form 79-VR" pendent street light with lateral bowl retractor; luminaire for intersection lighting, not shown, for operation on multiple or series circuits to 5,000 volts; heat-insulating hood, not shown. **General Electric Co.**, Schenectady, N. Y.

New incandescent luminaire for lighting of street and highway intersection, addition to "Form 79" line, makes use of a rippled bowl refractor to direct the light up and down the intersecting roads. Refractor is four-way distribution type that can be converted at the factory to three-way type. Pendent street light makes use of a new bowl refractor to provide more accurate control of the light distribution and resulting illumination on street pavement. It's available with refractors having two-way and C-way distribution. Heat-insulating hood makes use of a slip-fitter arrangement, which allows mounting and wiring from the side of the luminaire hood, plus an internal wet-process porcelain insulator through which the cable conductors pass, to protect the cable from temperatures in excess of 75 deg. C.

•

Motors

Totally inclosed fan-cooled motors. **Century Electric Co.**, St. Louis, Mo.

New line of totally inclosed fan-cooled motors is announced by this company. They are suggested for use in locations

where the air is foggy with metal-cutting solutions, or where there are abnormal quantities of metallic, abrasive and other dusts. Air intake passages are so designed that $\frac{1}{16}$-in. rod will not pass through them.

•

Burner Control

"Visaflame" control; in separate mounting types for industrial or domestic oil burners. **The Mercoid Corp.**, Chicago, Ill.

Light-actuated mercury switch is designed to operate in conjunction with safety control panels as power, ignition and flame failure shut-off for industrial and domestic oil burners. Device makes use of a gas-filled sealed glass bulb containing a mercury pool at the bottom with one immersed electrode. Other electrode contains two opposing bimetal coils arranged to compensate each other for ambient temperatures. Inner or smaller coil is located in front of concave mirror so that light rays from a flame striking the mirror focus on coil. Change of light energy into heat causes bimetal coil to rotate, moving the mounted electrode into the mercury to complete the circuit. Circuit stays closed with flame present, opens when it is gone.

•

Mercury Switch

"Tipit" mercury switch; operates on tilt of 20 deg. or more; capacity of $\frac{1}{2}$ amp. at 24 volts to 4 amp. at 6 volts. **Durakool, Inc.**, Elkhart, Ind.

Uses in explosive atmospheres and on electrical machinery are suggested for a new small mercury switch. Assembly is attached to door, lid or other movable member of low-watt circuit; movement actuates the switch.

•

Abraser

Testing machine for evaluating resistance of surface finishes to rubbing abrasion, including such materials as paints, lacquers, electroplated and plastic surfaces, as well as textile fabrics ranging from sheer fabrics to upholstery, is provided with load adjustment for varying pressure of wheels against specimen to suit type of material under test. Primary elements of device are motor-driven turntable on which specimen is mounted, counter to indicate number of abrasion cycles and two abrading wheels that alternately rub back and forth and, at the same time, crisscross in their rolling path.

"Research Model" Taber Abraser; motor either 115-volt, 60-cycle or universal type. **Taber Instrument Co.**, North Tonawanda, N. Y.

•

Lighting Strips

"P-F-C" Plastic Diffusing Strips. **The Edwin F. Guth Co.**, St. Louis, Mo.

Plastic strips that snap on are offered for those fluorescent lighting installations where "T-12"—1½-in.—lamps are used in open-type fixtures. They are said to reduce lamp brightness 30 per cent and yet to transmit more light than glass panels. White strips are suggested for general illumination applications, yellow strips with white lamps and pink strips with daylight lamps.

•

Developer

Print developer, consisting of separator roll, water roll and a series of bands that carry the developed prints through the drying section, makes use of a positive vacuum separator principle. Sensitized paper and tracings are fed into front of machine, where they are exposed in the printer section. Vacuum separator roll at discharge point of printer separates tracings from exposed prints, allowing prints to pass to developing and drying section, whence they are delivered flat and dry at the rear of the machine, while the tracing is returned to the operator. Developer is designed to operate at speed of printer which drives it; it may be used in conjunction with the company's "75" printer, which has a speed range of 0 to 25 ft. per minute.

"No. 159" Volumatic Developer. **Charles Bruning Co., Inc.**, New York, N. Y.

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Volt-Ohmmeter

Model "661" electronic tube volt-ohmmeter. **Radio City Products Co.**, 88 Park Place, New York, N. Y.

Applications in the electrical service field as well as in the laboratory are seen for this electronic meter. Input resistance varies from 16 megohms to 160 megohms; a.c./d.c. voltage range from 0.1 to 6,000 volts; resistance range from 0.1 ohm to 1,000 megohms; capacity range from 0.00005 to 600 microfarads.

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TECHNICAL LITERATURE

RADIO INTERFERENCE—Causes and cures of radio interference on transmission and distribution lines are discussed in an 8-page bulletin "Radio Interference Elimination for Public Utilities", announced by Sprague Products Co., North Adams, Mass.

LIGHTING STUDIES—Series of case studies on various lighting installations, with analyses of lighting problem and solution are being prepared by Wood Conversion Co., St. Paul, Minn. Most recent one considers re-lighted bowling alleys.

PHOTOMETERS—Photometers and illuminometers for lamp testing, lighting surveys, photometric research and education use are described and illustrated in Catalog E-72 of Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Descriptions are included for the bar photometer, sphere photometer and the Macbeth illuminometer.

BUILDING WIRES—"Interpreting the New Code in Terms of New Building Wires", is a recent booklet of General Cable Corp., 420 Lexington Ave., New York, N. Y. Ratings of the newly recognized types of wires and new ratings for Type R are graphically shown in tables for both new and rewiring classes of work. Copies of the 24-page publication may be secured from General Cable.

STREET LIGHTING—Reprinted in bulletin form the "Recommended Practice of Street Lighting, 1940," prepared by the Committee on Street and Highway Lighting of the Illuminating Engineering Society, is now available from society headquarters, 51 Madison Ave., New York, N. Y., at 15 cents per single copy. Publication is intended to furnish technical basis upon which effective street lighting may be designed, either as a coordinated plan for an entire street system or as a plan for any subdivision of such a system.

INCONEL—Technical information on the engineering properties of "Inconel" are contained in Bulletin T-7 issued by the Development and Research Div., The International Nickel Co., 67 Wall St., New York, N. Y.

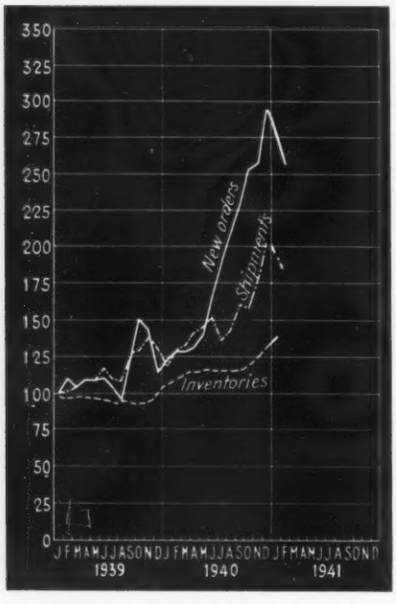
WELDING SUPPLY—How to properly lay out a plant distribution system for serving welders is shown in a report of the Subcommittee on Power Supply for Welding Operations of the A.I.E.E. Committee on Electric Welding. To obtain copies of the reprint, purchase order should be made out to the order of the American Institute of Electrical Engineers and sent to L. W. Clark, The Detroit Edison Co., 2000 Second Ave., Detroit, Mich. Quantities from one to 10 copies are priced at 10 cents each, plus postage.

PETERSEN COIL—Engineering Report No. 42 of the Joint Subcommittee on Development and Research, Edison Electric Institute and Bell Telephone System, describes theory of operation and extent of use of Petersen coils and discusses features of a Petersen coil system affecting inductive influence. Copies may be secured from E.E.I., 420 Lexington Ave., New York, N. Y., priced at 65 cents each to non-members in the U.S.A.

MANUFACTURING - MARKETS

January New Orders Show Decline of 12%

New orders for electrical machinery received by manufacturers in January were lower than in the preceding month and the index of the Bureau of Foreign and Domestic Commerce dropped more than 12 per cent. Iron and steel orders were up sharply and other durable goods showed a gain.



ELECTRICAL MACHINERY indices reported by Bureau of Foreign and Domestic Commerce

Electrical machinery inventories showed an expansion, the index for January rising to 140.6 from 133.9 for December. Inventories for all durable goods were greater. This reflected supplies on hand to fill orders yet to be shipped as unfilled orders showed a gain of 10 per cent in January over the preceding month for electrical machinery. Unfilled orders for other industries rose during the month, iron and steel being up 19 per cent.

The index of the value of manufacturers' shipments for January showed a decline to 183 from the 200 index for December. This decline in electrical machinery shipment was true for other durable goods.

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Equipment Exports Show January Rise

Exports of electrical equipment in January were the highest for any single month during or since the depression years, with a valuation of $13,069,670, as against $10,966,874 in December and $10,585,091 in January, 1940, according to report of the Department of Commerce.

Rubber-covered wire exported to world markets amounted to $437,029 in January, against $194,971 in the preceding month. Other insulated copper wire shipments were valued at $506,715, against $354,431 in December, 1940.

Electrical household refrigerators exported were declared at $560,423 in January, against $560,595 in the preceding month. Sale of electric refrigerator parts declined to $297,625 from $323,680 in December.

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Westinghouse Sells Plant

Sale of the Westinghouse Electric & Manufacturing Company's factory at Chicopee, Mass., to the Savage Arms Co. of Utica, N. Y., has been confirmed. It is expected that a force of 1,000 will be employed in the manufacture of machine guns for the United States and British governments. The property include 3.5 acres of land and seven buildings with 160,000 sq.ft. of floor space. About $100,000 worth of machinery will be installed, including electrical equipment to adapt the plant to defense material production.

General Electric Now Working at Capacity

For the first time in more than a decade productive facilities of General Electric Co. approached full utilization during 1940, according to the annual report to stockholders. Chairman Philip D. Reed and President Charles E. Wilson stated that following the announcement of the national defense program the volume of orders received increased so rapidly that enlargement of capacity of several of the company's plants was undertaken.

"The urgent need for getting defense production under way," it was stated, "coupled with rapidly increasing commercial requirements, created problems that were both numerous and complicated. Many of these problems have already been solved and the great task of obtaining maximum output with minimum delay is well in hand."

Capital expenditures for plant and equipment totaled $19,837,803 during 1940, compared with $11,024,485 in 1939. The 1940 expenditures included about $15,000,000 for the normal requirements of business, and about $5,000,000 for buildings, equipment, etc., required in connection with production for national defense.

Profit and loss account compares as follows:

	1940	1939
Net sales billed	$411,938,259	$304,680,270
Costs & exp.	281,412,443	237,113,983
Fed. income taxes	54,943,000	21,013,000
Excess profits tax	18,000,000	.....
Depreciation	14,805,495	13,893,184
Income from sales	$42,777,321	$32,660,103
Other income	13,463,762	8,575,541
Net income	$56,241,083	$41,235,644
Common divs.	53,294,446	40,305,054
Surplus	$2,946,637	$930,590
†Rev. of inv. for undistr. earn. of affil. co., net	‡1,094,679	‡708,059
Previous surplus	124,310,036	122,671,387
Surplus	$128,351,352	$124,310,036

† Revaluation of securities of an investment character, carried directly to reserve for investments. ‡ Credit.

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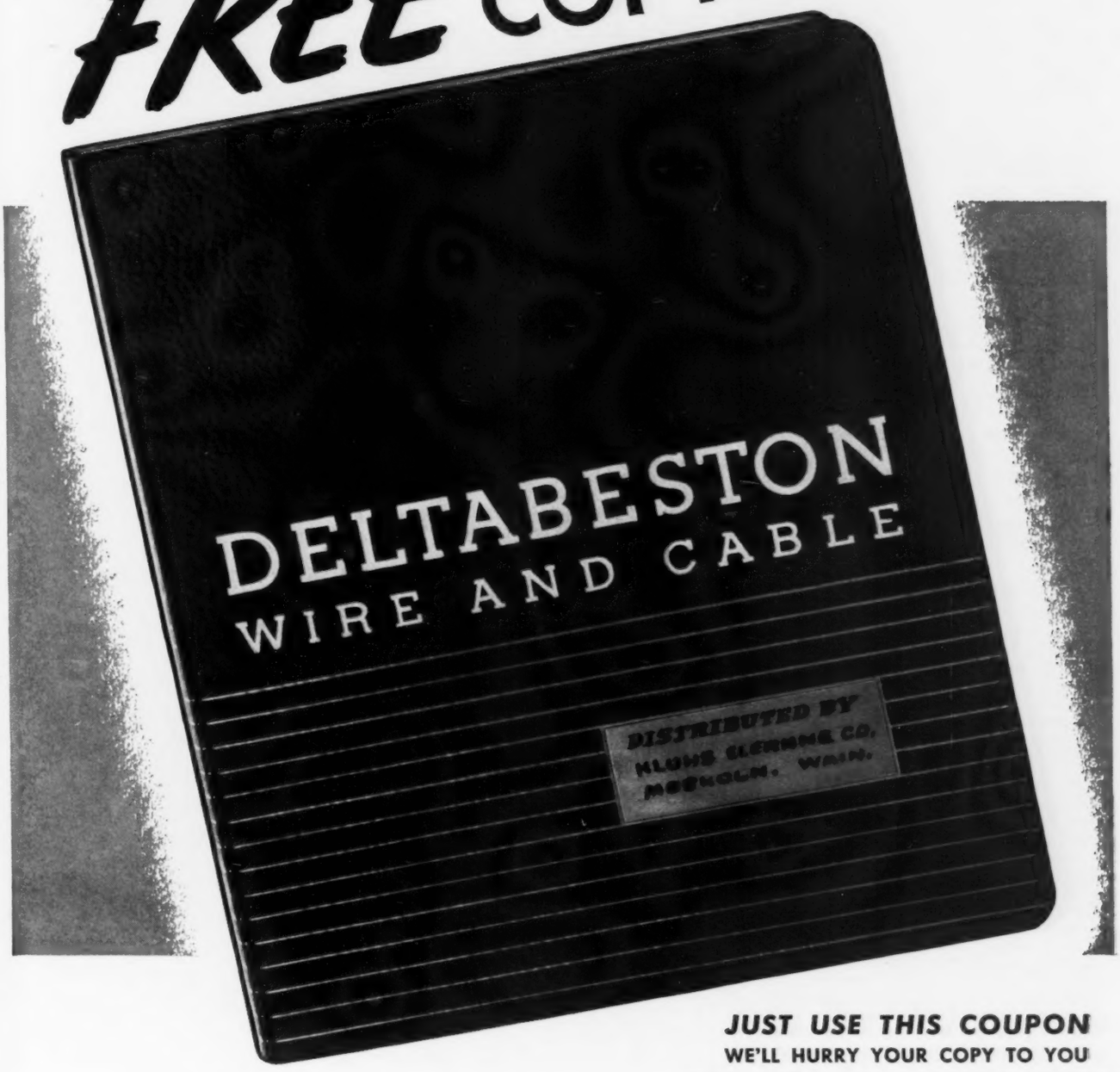

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GENERAL ELECTRIC

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1940 Reports Show Increased Income

Reliance Electric & Engineering Co., Cleveland, Ohio, showed a net profit for 1940 of $356,740 after provision for federal income taxes of $198,000 and after all charges, including depreciation on plant and equipment amounting to $88,253. This compares with a net profit of $205,007 for 1939. Earnings for 1940 were equivalent to $2.38 per share on the 150,000 shares of the company's stock outstanding, as compared to $1.38 per share for 1939.

Shipments for the year totaled $4,196,144, compared to $2,473,080 in 1939. Taxes—county, state and federal—for 1940, including social security taxes, amounted to $278,468, or $1.85 per share. In his letter to shareholders accompanying the report, Clarence L. Collens, president of the company, stated that production had been stepped up by a $200,000 addition to plant equipment and improvement in facilities, by building up plant personnel to more than double the number employed at the middle of the year and by operating the plant with two shifts working overtime hours.

Other manufacturing companies issuing reports covering 1940 operations include:

CROCKER-WHEELER ELECTRIC MANUFACTURING—Net income, $36,836 after depreciation, taxes, interest, etc., but before adjustments. Including $331,693 extraordinary charges and provisions for losses, there was a net loss of $294,857. This compares with net loss in 1939 of $61,236 before adjustments. Including $243,420 various adjustments there was a deficit for that year of $304,656.

MCGRAW ELECTRIC—Net profit of $1,454,933, after depreciation, federal and state income and excess profits taxes, etc., equal to $3.08 a share on 472,600 shares of capital stock, excluding 27,400 treasury shares. This compares with $1,413,182 or $2.99 a share in 1939. Sales amounted to $8,262,044 against $6,919,554. The upward trend in sales in 1940, which was accomplished without the aid of new products, is continuing in 1941 with volume for the first two months sharply above a year ago, according to Max McGraw, president. "Subject to interference, which may be brought about by the possible shortage in certain raw materials, tools, etc., we would expect the upward trend to continue," he added. "Business due to war conditions has thus far been confined to items included in our regular line of products."

New York Metal Prices

	March 18, '41 Cents per Pound	March 12, '41 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.75	5.75
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.25	51.75
Aluminum, 99 per cent	17.00	17.00

* Delivery Connecticut Valley.

Field Reports on Business

Industrialists see the lease-lend bill meaning higher taxes, longer work-week and decreasing margin of profits. Utilities are buying a variety of electrical equipment, with manufacturers' backlog swelling. Government buying continues to be biggest factor in activity. More plant expansion is due.

NEW YORK

Higher taxes, longer hours of work and probably smaller profits constitute the formula President Roosevelt has laid down to meet the lease-lend bill. Actual expenditures of around $2,000,000,000 a month will be pumped into business channels to bring about the greatest industrial activity yet known. Prospects are that there will be priorities covering all essential defense materials and substitutes will be the rule for domestic products. Consumer goods will be hard hit by priorities and there will be strict rationing.

While the flood of government orders is increasing backlogs in this area, department store sales in the area were off one per cent last week. Chances are that the percentage rise of past months will grow smaller from this point on because most plants are operating near or at capacity. New plants will be needed to meet production schedules.

Utilities are still heavy buyers of electrical equipment. Recent orders include oil circuit breakers, transformers and network protectors, cable, switchgear and regulating and reclosing feeder equipment. Line hardware and station equipment orders are due to increase with the coming of spring.

Engineering construction awards for last week were more than triple the volume of a year ago and topped awards of the previous week by 28 per cent. *Engineering News-Record* reports awards to date for 1941 of $1,256,538,000, a 130 per cent gain over the eleven-week 1940 period.

NEW ENGLAND

Large backlogs of orders built up by government awards in this area are increasing further through the strong demand for the products of the heavy industries. United Illuminating Co., New Haven, has bought two B. & W. boilers operating at 725 lb. sq. in. pressure for its Steel Point station and Holyoke Gas & Electric Department has ordered a Westinghouse 5,000-kw. turbo-generator to cost about $146,770.

Industries are being maintained at full capacities among all metal and machine tool lines. Collyer Insulated Wire Co. has an order for $212,704 worth of electric cable, and Rockbestos Products Corp. has been awarded a $17,448 electric cable order. American Brass has received an order for condenser tubes amounting to $67,293 and Vickers, Inc., Waterbury, Conn., has been awarded $54,657 worth of variable transmissions for the government. D. E. Whiton Machine Co., New London, Conn., has been awarded a contract for turbo-generator sets amounting to $17,108.

A. L. Smith Co., Chelsea, Mass., has received a contract for supplying 2,400 8-ft. and 1,000 4-ft. length flush type reflectors for fluorescent lighting to be installed in the New England Mutual Life Insurance Co. building now approaching completion in Boston. Sales of reflectors are in good volume and floodlighting equipment for airport lighting in this area is very active. One manufacturer reports orders for several 1,000-unit lots of reflectors for incandescent lamps for army barracks; industrial lighting is very active.

Cornell-Dubilier Electric Corporation has acquired a mill in New Bedford, where machinery will be installed for carrying out defense material orders of which this company has a large volume. Industrial space in Lawrence, Mass., and Manchester, N. H., is being absorbed by new industries.

PACIFIC COAST

February building permit total for the seven Western states increased 50 per cent in value over January and more than doubled that for February, 1940. This average was bettered by Oregon and Washington. Lumber production is now 105 per cent of its estimated capacity, due to unexpectedly sustained volume of emergency construction, ranging from shipways to temporary housing.

Pacific Gas & Electric Co. is ready to construct seven miles of 27-ft. horseshoe tunnels for its two new plants on Feather River, their combined rating being 203,000 hp. Recent contracts cover $352,876 for four substations and increased underground distribution for Mare Island; $28,470 for condensers and auxiliaries for Burbank steam plant; $57,491 for 118 miles of 115-kv. line for Elephant Butte plant in New Mexico; $47,240 for 55 miles of 7,200-volt wooden pole transmission line in Clackamas area, Oregon, and $16,613 conduit and fittings for Central Valley project with an additional Friant Dam order for 250,000 ft. of 1-in. pipe.

Electric welding business is particularly good, with several single orders averaging $70,000 reported in the Bay area, the largest order being for $115,000 for a yard building 30 British cargo carriers, which also has bought two 23-ton electric locomotives for $30,000.

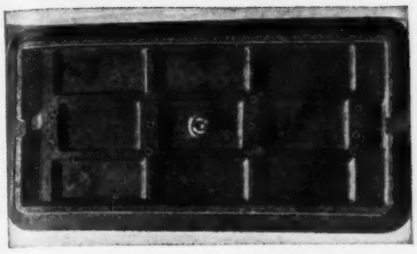
CHICAGO

The tempo of business was stepped up still higher as industrial operations were being pushed to the limit to meet incoming orders. The pressure on electrical manufacturers is becoming more acute to keep up with the large volume of new orders. Utilities are buying equipment in sizable amounts for new construction.

Additional plant expansion projects announced to fulfill government contracts are: Electro-Motive Corp., $1,868,000; The Walworth Co., $540,000; Stewart-Warner Corp., $389,000. Central Steel & Wire Co. is installing 288 circuits, 3,400 lights and 58 motors totaling 594 hp. in its plant. The city electrical department requested bids on 121,800 ft. of No. 8 rubber-insulated wire and 8,000 line insulators.

Defense contracts involving $5,851,000 were awarded here last week, including the following electrical items: X-ray equipment, $199,517; motor-generators, $32,222; lamps, $38,869; metering devices, $78,454; coils, $34,776; generating unit, $33,790; rectifiers, $8,940; switchboards, $44,200.

Dealers report retail trade averaging from 7 to 11 per cent over a year ago, with the demand for electric appliances exceptionally good. The demand for fluorescent equipment is boosting lighting sales to a high level.



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With tensile strength of 8,000 lbs. per sq. in. . . . compressive strength of 25,000 lbs. per sq. in. . . . specific gravity 1.4 and average dielectric strength of 125 volts per mil CELORON is proving an efficient and economical material for many parts in electrical equipment where mechanical as well as electrical stresses are encountered. Its further resistance to moisture, chemicals, and temperatures up to 290° F. adapt it to use for parts subject to corrosion. For more information about CELORON ask for booklet MP-12.

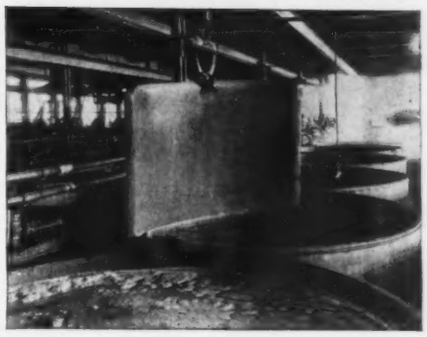
Permanent Name Plates

C-D offers a grade of Dilecto laminated phenolic plastic sheets with a white core so that lettering engraved through the black surface exposes the white providing a name plate that will permanently retain its brilliance. Since Dilecto is unaffected by moisture, chemicals, oil, or temperature changes name plates made from this grade designated as CBW can be used anywhere. Samples and quotations on request.

There's no way to hurry the processing of Vulcanized Fibre

C-D started building up thick fibre sheet stocks when business was still "in the dumps." Today C-D customers can get much needed thick Vulcanized Fibre. Material in process guarantees no break in this supply line. The whole story of Vulcanized Fibre manufacture is told in C-D catalog DF-12. Send for a copy.

2" thick Vulcanized FIBRE SHEETS are in continuous process for a full year!



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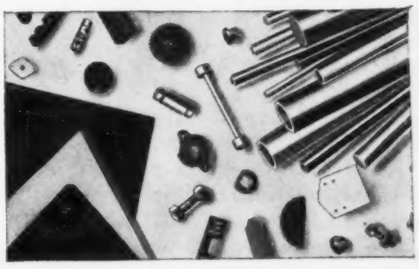
have made possible many of the advances which equipment manufacturers are advertising in **Electrical World.**

One manufacturer utilizing VULCOID insulation has greatly improved and made safer the arc extinguishing chamber of a circuit breaker. Another manufacturer is building extra safety into his equipment with high voltage DILECTO insulation. Still another manufacturer has been helped in designing space saving equipment by the judicious use of molded fabric CELORON insulating parts. These product improvements were not achieved by hit or miss use of proper insulating materials. Rather, our technicians studied the problems involved and developed from standard C-D insulating materials special grades or combinations of materials to meet the specific problem.



We can help accomplish the same results for you. As a first step, send for our new booklet "What Material?"—form GF-12.

CONTINENTAL-DIAMOND FIBRE CO., NEWARK, DEL.

SUPPLIERS OF LAMINATED PHENOLIC & MOLDED FABRIC PARTS NOW BEING USED BY LEADING ELECTRICAL MANUFACTURERS

C-D Products

DILECTO—A laminated plastic possessing unusual electrical insulating, mechanical and moisture resistance properties.

VULCOID—A laminated resinous fibre combining to a high degree the desirable properties of laminated phenolic and vulcanized fibre.

DIAMOND vulcanized **FIBRE**—A tough, hard, bone-like material of high dielectric and great mechanical strength.

MICABOND—Mica in its most usable form—sheets, tubes, segments, rings, punched and formed parts.

CELORON SILENT GEARS—Absorb vibration, reduce noise, save wear and tear on machines and men.

CELORON—A molded phenolic fabric base plastic of exceptional mechanical strength, attractive appearance, light weight and great stability.

NEWS ABOUT PEOPLE

L. I. Lighting Assigns New Duties to E. W. Doebler

Errol W. Doebler was elected a vice-president of the Long Island Lighting Co. in charge of gas and electric operations, engineering and construction at a meeting of the directors of the company held after the annual stockholders' meeting last week. Prior to this time Mr. Doebler had been elected a vice-president of the Nassau and Suffolk Lighting Co. and the Long Beach Gas Co.

Mr. Doebler was first employed by the Long Island Lighting Co. in 1927 as assistant to Fred H. Maidment in the commercial department in Nassau County and served in that capacity until 1937. He was then appointed to the position of general operating manager in charge of gas and electric operations, engineering and construction for the Long Island Lighting Co. and gas operations for the Nassau and Suffolk Lighting Co. and the Long Beach Gas Co., and he has served in that capacity until the present date. He is also responsible for the general supervision of the transportation department and the safety department.

E. W. Doebler

A native of Williamsport, Pa., and a graduate of Cornell University, Mr. Doebler, before joining Long Island Lighting Co., was associated with the Portland Cement Association, Hazen, Whipple & Fuller, consulting engineers, and with the teaching staff of Swarthmore College.

FRED H. MAIDMENT, vice-president Long Island Lighting Co., who has passed the age limit fixed by the company's retirement annuity plan, has been relieved of administrative duties, but will remain a director of the company and act hereafter in a consulting capacity. He has been associated with the company and its predecessor companies for 40 years.

THOMAS P. BOOTH was appointed controller and will continue to be the chief accounting officer and in charge of the accounting department.

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▶ WILDON F. WHITNEY, Madison, Wis., has been confirmed as a member of the Wisconsin Public Service Commission by the state Senate for the term ending March, 1947.

▶ H. P. HOHEISEL, sales department, Oklahoma Gas & Electric Co., has been named advertising and publicity manager of the company to succeed the late Leonard F. Nelson. Mr. Hoheisel has been connected with the Oklahoma utility for 21 years.

▶ HENRY A. DOERING, vice-president of Westchester Lighting Co., has been elected vice-president of Yonkers Electric Light & Power Co. and a director of both companies. Mr. Doering has been affiliated with the electric and gas industries in Westchester County for nearly 42 years. Starting with Westchester Lighting's predecessor company, he advanced in the ranks and in 1920 was appointed assistant secretary, secretary in 1926 and vice-president in 1929.

North American Elects Moody Vice-President

Ralph E. Moody, who was appointed assistant to the president of the North American Co., New York, last year, was elected a vice-president of the company

last week at the meeting of the board of directors. Mr. Moody was formerly an officer of the Wisconsin-Michigan group of companies in the North American System.

Directors also elected four new members to the board to fill vacancies. The new members are: E. G. Crawford, president of the Cleveland Electric Illuminating Co.; William McClellan, president of Union Electric Co. of Missouri; A. G. Neal, president of Washington Railway & Electric Co. and Potomac Electric Power Co., and Mr. Moody.

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J. ARTHUR GIBSON, vice-president and assistant treasurer of the Simplex Wire & Cable Co., has been elected a director of the company.

SIR ANDREW DUNCAN has been elected by the council of the British Institution of Electrical Engineers as an honorary member in appreciation of his outstand-

FOR MAKING RAPID MEASUREMENTS

TYPE 650-A IMPEDANCE BRIDGE $175

RESISTANCE · INDUCTANCE · CAPACITANCE

● THIS completely self-contained bridge, with built-in 1,000-cycle and d-c power supplies, is direct reading in resistance, inductance, capacitance, dissipation factor (R/X), and storage factor (X/R or Q) over extremely wide ranges. Always set-up and ready to use, it is proving very valuable in hundreds of laboratories or factories. Its very wide ranges . . . its portability . . . its direct-reading feature and its simplicity of operation all contribute to the continued popularity of this instrument as one of General Radio's most widely used bridges.

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1 PERMANENTLY VIBRATION PROOF

The lock washer between the nut and the lower pad positively prevents the nut from slipping, gives you a contact that is guaranteed to be permanently vibration proof.

2 INCREASED CONTACT SURFACE

The upper floating pad of the PERMA-LOK Connector fits *around* stranded conductors as well as between them. The result is larger contact area, a *better* electrical connection.

3 LONGER CONDUCTOR LIFE

Wire strands are made safe from mashing by the circular surface of the floating pad which distributes the pressure over a large area, increasing the life of the conductor.

And of course L-M PERMA-LOK Connectors bring you the same precise machining, the same rugged strength and re-usability that is characteristic of all L-M standard High Strength Connectors. The Perma-Lok is available in all standard sizes from 1/0 stranded to 1000 MCM stranded.

LINE MATERIAL COMPANY
GENERAL OFFICES · MILWAUKEE, WISCONSIN

ing public services, especially to the electrical industry during his eight years of office as the first chairman of the Central Electricity Board.

•

Hygrade Sylvania Elects Healy Vice-President

At a recent meeting of the board of directors of the Hygrade Sylvania Corp. F. J. Healy was elected a vice-president of the corporation. Mr. Healy, who is also a director of the corporation, first

became identified with the corporation in 1917 and since that time has assumed increasing responsibilities as the corporation has grown.

As vice-president Mr. Healy will continue his duties as general manager of the lamp division with headquarters at Salem, Mass.

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Promotions in Electric Department Announced

Public Service Electric & Gas Co. has made several promotions in the electric engineering department, general office, Newark, N. J.

Herman Weisberg has been made mechanical engineer, Roelof Blonk structural engineer and Bert Dugdale assistant structural engineer.

Mr. Weisberg, a graduate of Cornell University, started with United Engineers & Constructors, Inc., in 1928 as operating and supervising engineer. In 1935 he joined Public Service as planning and installation engineer in the generation department and the following year he was transferred to the electric engineering department as assistant mechanical engineer.

Mr. Blonk was graduated from the University of Holland at Delst, Holland, in 1922. He started with Public Service Production Co. in 1923. In 1936 he was

pounds of carbon electrodes. We have to obtain the equipment (transformers, rectifiers, and the like) to feed 162,500 kw. of electricity into the reduction furnaces. This is a generating capacity equal to that of the state of Delaware plus twice that of Mississippi.

WHAT OF TOTAL PRODUCTION? In addition to Vancouver further installations are being made at other of our plants, so that in less than a year their total capacity will be more than double that of 1939, when 327 million pounds were produced.

IN THE VERY MIDST of this demand we have lowered the price of aluminum ingot 15%. We state, without reservation, our hope that the price can be still further reduced.

DEFENSE APPLICATIONS use aluminum for exactly the same reasons you do. Defense priorities on aluminum simply say that there are some fundamental things that aluminum does supremely well. It will do them still better as important lessons in production, fabrication, and application are learned from every additional pound being produced and used.

YOU, SIR, have been using aluminum conductors and bus bars. It is not easy nor convenient to have to substitute other materials temporarily. We want you to know that we intend to make this hardship as short-lived as possible. Your aluminum is on the way. It is a promise.

ALUMINUM COMPANY OF AMERICA

You cut out waste motion when you use the Fargo Connector. It's built as one unit, free from loose parts, and *always threaded.* No time lost starting a nut, no chance of cross threading.

Re-use the Fargo Connector, again and again. With its rugged Everdur body and Duronze bolt, the Fargo Connector "grips like a vise" every time.

Made by
FARGO MFG. CO.
Distributed by

LINE MATERIAL CO.
MILWAUKEE, WIS.

transferred to the electric engineering department.

Mr. Dugdale started with Public Service Electric in 1914 as a draftsman and has been in the electric engineering department since 1935.

•

▶ R. W. WILSON, engineer of Lexington, Ky., has been elected chairman of the Kentucky Chapter, International Association of Electrical Inspectors. Mr. Wilson succeeds Robert J. Heffernan.

▶ C. W. BRAKENSICK, president and director of the Mastergrip Utilities Supply Corp., St. Louis, Mo., has resigned. Mr. Brakensick has served as chief executive and on the directorate of the company since its organization in 1935.

▶ SAMUEL A. MCWILLIAMS, resident engineer at the Minidoka power plant in Idaho for the last year, has gone to Parker Dam as construction engineer in charge of power plant work, to succeed Edward C. Koppen, who died last November.

▶ C. I. MACGUFFIE has been appointed manager sales, electric welding section, General Electric Co. He succeeds L. D. Meeker, now associated with the Smith-Meeker Engineering Co., New York. Mr. MacGuffie has been assistant to Mr. Meeker in Schenectady since 1939. He is a past chairman of the Philadelphia section of the American Welding Society, and is now a member of the Schenectady section of this society.

▶ A. R. RUTTER has been appointed assistant manager of the engineering department of the meter division of the Westinghouse Electric & Manufacturing Co. at Newark, N. J. A graduate of the University of Pittsburgh, Mr. Rutter joined the Westinghouse engineering department at East Pittsburgh in 1918. He has specialized in meter design throughout his career with the company. When the engineering department was transferred from East Pittsburgh to Newark, in 1928, he became section engineer of watt-hour meters, a position he held until his new appointment. He is a member of the American Institute of Electrical Engineers. T. D. BARNES, a Westinghouse meter engineer since 1926, will become the new section engineer of watt-hour meters. J. M. HEGGY has been named instrument section sales manager for the meter division. Mr. Heggy joined Westinghouse as a junior graduate student in 1930 and was assigned to work in the meter division after graduation from Purdue University in 1931.

OBITUARY

Charles S. Richards

Charles S. Richards, managing director of the Metropolitan-Vickers Electrical Co., Ltd., Manchester, England, was drowned at Rio de Janeiro recently, where he had gone as a member of the British mission to South America. Mr. Richards was 56 years old. After taking a first class honors degree at Manchester University, Mr. Richards joined Metropolitan-Vickers (then the British Westinghouse Co.) and had been associated with that company for 38 years, interrupted only by army service during the last war.

Mr. Richards concentrated on the electrical export trade, and over a period of many years he visited almost every country in the world. One of his chief activities was directed toward the establishment of his company's business in Europe and the Far East, including many years of active trade with Russia. In 1922 Mr. Richards became managing director of Metropolitan-Vickers Export Co. and in 1933 he was appointed a director of Metropolitan-Vickers Electrical Co.

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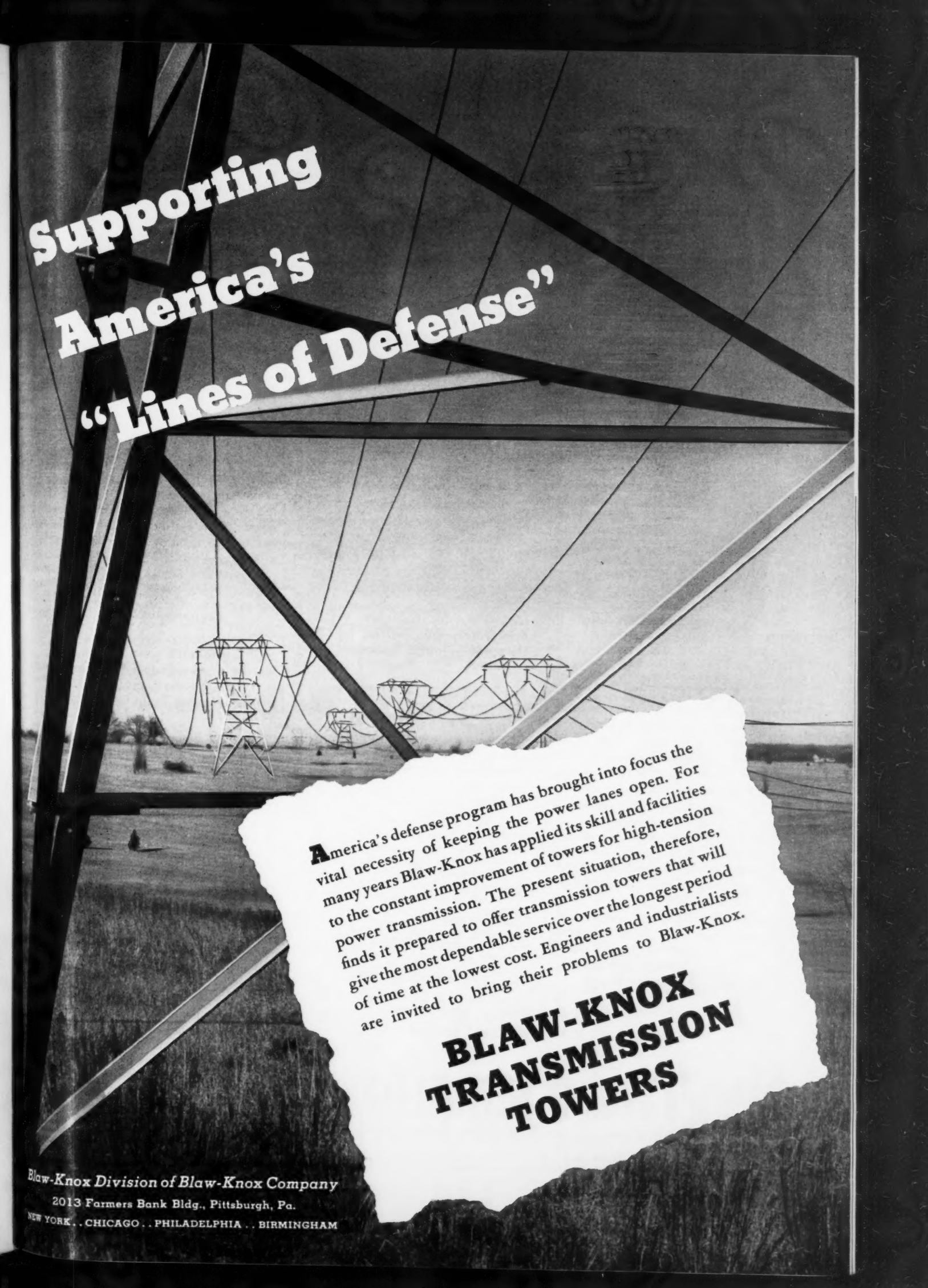
▶ LEONARD F. NELSON, advertising and publicity manager of the Oklahoma Gas & Electric Co. for the past seven years, died on January 25. Mr. Nelson joined the utility organization in 1926.

▶ J. J. GREENE, vice-president of the Johns-Manville Sales Corp., died on February 27 at Avon Park, Fla., where he was on vacation, following a heart attack earlier in the afternoon while he was playing golf. Born in London, England, in 1878, Mr. Greene went to Canada at an early age and later to the United States. He joined the Johns-Manville organization in 1906. Mr. Greene was well known in the electrical and utilities fields. He was a member of the National Electrical Manufacturers Association and also of the American Gas Association.

▶ LAWRENCE J. MONTGOMERY, manager of the special business bureau of the sales department of the Consolidated Edison Co. of New York, died in West Palm Beach, Fla., on January 21. Mr. Montgomery was 56 years old. He entered the employ of the New York and Queens Electric Light & Power Co., Consolidated Edison subsidiary, in 1911 and in 1934 he became general sales manager of the company. During that same year he was transferred to the parent organization. Last September he was made head of the special sales bureau.



America's defense program has brought into focus the vital necessity of keeping the power lanes open. For many years Blaw-Knox has applied its skill and facilities to the constant improvement of towers for high-tension power transmission. The present situation, therefore, finds it prepared to offer transmission towers that will give the most dependable service over the longest period of time at the lowest cost. Engineers and industrialists are invited to bring their problems to Blaw-Knox.

BLAW-KNOX TRANSMISSION TOWERS

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NEW YORK . . CHICAGO . . PHILADELPHIA . . BIRMINGHAM

Fluorescent at its Finest by HYGRADE *the pioneers*

Recommend Miralumes and you recommend the finest in fluorescent fixtures!

Completely guaranteed by Hygrade—lamps included!

WHAT'S the best Fluorescent to recommend? Listen to this *exclusive* combination of advantages found in Hygrade MIRALUMES! . . .

Finer light (Hygrade's patented lamp coating) . . . *sure, trouble-free starting* (Hygrade's patented Mirastat starters) . . . *lower maintenance* (Hygrade's easily demountable reflectors and sturdy lamp holders) . . . plus *a complete guarantee* covering every part!

MIRALUMES are *quality manufactured* . . . better designed and engineered . . . sold wired, ready to install, complete with superior Hygrade Lamps . . . Underwriters Laboratory approved!

Hygrade's progressive Laboratories are constantly improving product quality and stimulating wider interest in more and better light, thus meriting your support.

NEARLY 100 PATENTS PROTECT HYGRADE PRODUCTS! Extraordinary lighting efficiencies are obtained in Hygrade Fluorescent Lamps by tuning the ultraviolet energy to the 2537 Angstrom Units wave length effective in causing the porous film (Hygrade Patent #2,096,693) to generate light as shown in Hygrade-controlled Patent #2,126,787. Hygrade products are exclusively protected by a large number of other patents, including #2,201,817 and #1,982,821.

EVERY MIRALUME EMBODIES A HIGH POWER FACTOR, LOW STROBOSCOPIC CIRCUIT

Hygrade MIRALUMES

World's Only Completely Guaranteed Fluorescent Lighting Fixtures

Hygrade Sylvania Corp., Ipswich, Mass. Est. 1901. Also Makers of Hygrade Fluorescent and Incandescent Lamps and Sylvania Radio Tubes

Effective Employee Training Conferences

[*Continued from page 55*]

supervisor his exhibitions of good and bad conference technique.

The efficiency of the supervisors as conference leaders will improve with each conference they conduct. Having previously sat through, at rehearsal meetings, a discussion of the questions they will put to their own groups of employees, they are confident that these questions will promote interesting discussion in the meetings they conduct. Usually by the time these supervisors have led three or four conferences they will become quite expert at directing discussion. A part of each rehearsal meeting is also devoted to consideration of methods of handling typical conference situations. Each supervisor spends about 1½ hours monthly in the rehearsal meeting, and devotes an equal length of time to each of the one or two monthly employee meetings he conducts. The individual employee devotes but 1½ hours monthly to attendance at a training conference.

Conference Subjects

The first step in installing a public relations training program employing the rehearsed-conference method is to state the fundamental question to the conference group. It is: "What are the factors which influence the attitude of the public toward our company?"

The answers to this question are written on the blackboard. Included among these will be the following:

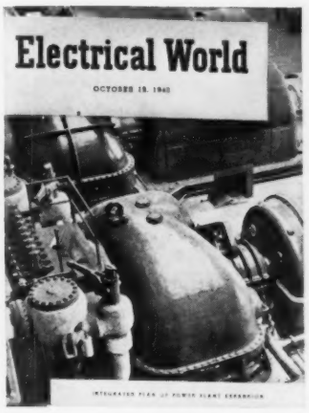
1. The physical service rendered by the company.
2. Rates.
3. Personal service rendered by employees.
4. Publicity—advertising, stuffers, radio, billboard, newspapers, etc.
5. Appearance of buildings and equipment.

When this development has been completed, the order of importance of the factors listed, in the opinion of the group in conference, is established. "Personal service of the employee" will rank high in this list, in the estimation of these public contact employees.

Near the close of the first meeting the supervisor will ask: "Which factor among these can we, as public contact employees, control?" This question focuses the group's attention

Thanks to You

Electrical World continues to be the most VITAL magazine in its field.



YES, thanks to your cooperation with our editors, and with the trained inquirers whom McGraw-Hill sends out to interview readers, Electrical World continues to provide active leadership.

For, together with other McGraw-Hill publications, Electrical World has established a program of editorial research conducted by a staff of especially trained men. These interviewers make personal calls on subscribers at work in the field and in their offices in all sections of the country—to find out from them why they read Electrical World, how they use it, what they like best, what they pass up.

On each visit, a specific issue is gone through from cover to cover, and every page, every item, is weighted according to its value to the interviewed subscriber.

An original and farsighted step in journalistic practice, the idea behind the plan is to help the editors better to gauge the needs of subscribers so that they may provide a progressively better service.

This program can be successful only through your cooperation. Thanks to you, it has already been of tremendous help to our editors; and we are confident that the benefits of these interviews will be felt throughout Electrical World's readership.

In the hope that readers may find suggestions for new uses and applications for the magazine in the comments of other readers, we are publishing some of the remarks made during interviews held so far.

READER COMMENTS

"The type of article most useful to me is of a general lighting and merchandising nature. The news issue always interests me and the Personal section helps keep me up to date on the more important organization changes."

★

"'Street Lighting in Kingston'—That's right in my line. I copied some of the figures in there. We're about to go into a street lighting campaign so this article was doubly interesting."

★

"Had an interesting article about a year ago on Glass tape. Fact that salesman came through about same time made it more interesting. Knew about it before he arrived, thanks to E. W."

★

"Distribution Problems—very helpful pointers on different ways of doing. For instance, the article they had about Detroit—I followed out their idea and it's been directly helpful in many ways."

★

"Off peak water heaters—had a very interesting article about measuring the number of gallons of hot water used at time of peaks. Had a meter, but never knew at what time or how much the peaks were. The article straightened us out on this all right."

★

"My copy is made available to my men, most of whom read it with regularity. Articles of interest to my department are not only read by my men but clipped and filed under appropriate subject head."

★

"Capacitors Release—This was right in my line—good articles. Commercial Cooking—I'm interested in load building. Editorials—I always read those, I like to get the editor's slant. Operating Practices—I usually find some pretty good information in this. Those outdoor regulators they have in Lynn interested me particularly. I think the magazine is pretty well balanced but of course I can always read more on distribution."

Electrical World

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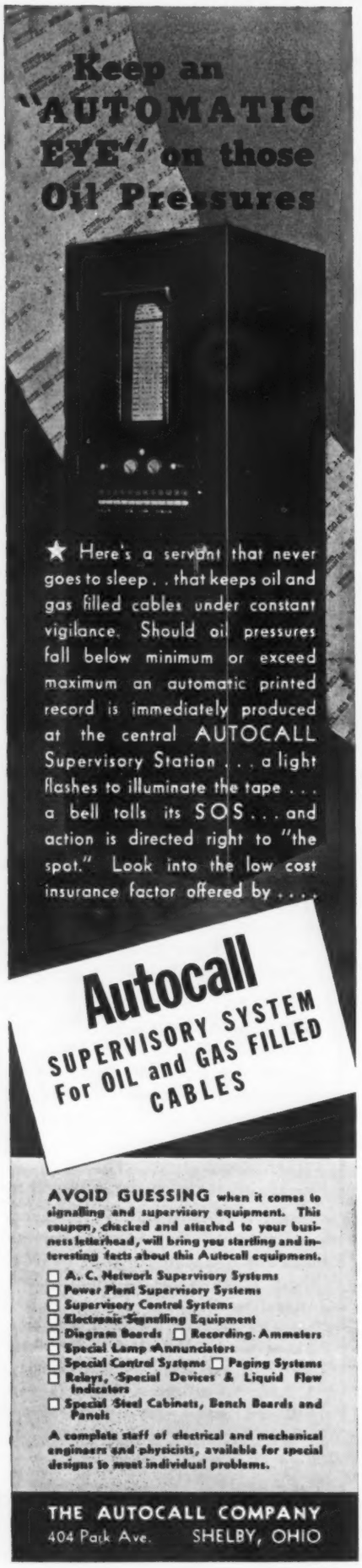
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THE AUTOCALL COMPANY
404 Park Ave. SHELBY, OHIO

on the factor of personal service, and the supervisor announces, in closing this meeting, that all future discussion in this series of conferences will be confined to this one factor.

At the opening of the second meeting with his group, the supervisor will list the elements of employee personal service on the blackboard and these will be discussed. These elements are as follows:

1. The interest shown by the employee in the consumer's problem.
2. The quality of information given to the consumer by the employee.
3. The quality of the employee's speech.
4. The employee's politeness.
5. The employee's appearance.

In succeeding meetings of this course one or more conferences will be devoted to a discussion of each of these elements of personal service. As many as three conferences may be given over to discussion of the first two elements, "Interest" and "Information." The training supervisor prepares conference plans which contain a variety of good, thought-provoking discussion questions based on practical contact cases, and dealing only with the element of personal service under discussion at the time.

The foregoing outline will take care of a year's work, if the meetings are held monthly.

Flexible Program

In these conferences dramatizations may be employed as a teaching device, in which two employees prepare and present, at each meeting, a dramatized contact between an employee and a consumer. These contacts must purposely be made imperfect, and the conference group, in the general "post-mortem" discussion which follows such a presentation, must be able to point out the "bugs" in the contact. All such criticism must be made in terms of the foregoing five elements of personal service; that is, the employee's interest, information, speech, politeness or appearance must be at fault.

A public relations training program developed in this manner is remarkably flexible. At any time the regular course may be interrupted for a special round of employee meetings on any subject which is of particular interest to management. It is only necessary that the training supervisor be furnished the required information in order that he may draw up a conference plan for such a special session.

Develops Loyalty

In the same manner, there may be interpolated in the course outline meetings devoted entirely to a study of company history, organization and policy. For such meetings it is best that mimeographed brochures be prepared on the particular subjects, and these are read and discussed by the group members. The underlying purpose behind all training of this type is the development of greater loyalty toward the company—a loyalty based upon a better understanding of what the company stands for. Intelligent loyalty cannot be displayed by the employee unless he knows something about the company beyond the limits of his own job.

Ordinarily, public relations training is given only to those employees who regularly contact the public in the performance of their duties. In certain crises in company affairs, however, the training program is expanded to cover the entire personnel of the company. Such a crisis might well be a municipal election of some sort. In such an instance I have met with upward of 150 supervisors in a giant rehearsal meeting, and these supervisors have then conducted, within a week's time, conferences with more than 6,000 employees. In this manner exact information may be put over to every employee in the company regarding the issues at stake and complete and intelligent co-operation secured from each employee. Usually, two such rounds of meetings suffice in caring for such an emergency.

Small Personnel

Once the rehearsed-conference method of training has been set up in a utility, the training supervisor, with a staff of two or three typists, can carry a training program which otherwise would require the full-time services of ten to twenty instructors.

More important, however, is the fact that such a training set-up becomes, in an emergency, a powerful and potent managerial instrument, by which every employee in the utility can be reached at the same time with a complete picture of a situation confronting the company.

Pug mill to the job in 12 DAYS...

CAT. No. 3701

"A SPECIAL wall bushing for use on high amperage, low voltage bus work." That was the order handed to us by a customer on the eighteenth. A routine job but for the fact that they had to be delivered to him by the first of the following month.

The same afternoon, because the whole Pinco organization is set up for efficient service, the clay for those bushings was being fed to the pug mill. Twelve days later they were being installed "right" on the job.

If you have any wall bushing problem, whether it's a problem involving delivery dates, mechanical or electrical tolerances, get in touch with your nearest Pinco representative listed below. Write or ask for complete Pinco catalog.

The Porcelain Insulator Corporation, Lima, N. Y.

SALES AGENTS—The Joslyn Company—New York, Rochester, Philadelphia, Baltimore, Lynchburg, Va.; Joslyn Manufacturing & Supply Co.—Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Jobbers Supply Co.—St. Paul, Portland, Seattle; Southeast Joslyn Company—Cincinnati, Cleveland, Westerville, O., Lexington, Ky., Atlanta, Jacksonville; J. J. Costello—Boston; Joslyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; H. E. Burns Co.—Pittsburgh; Southern Joslyn Co.—New Orleans; Paul Douden—Denver; Paul Carson—Amarillo, Texas; Joslyn Southwest Co. Dallas, Houston.

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RIGHT *on the job*

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YOUR
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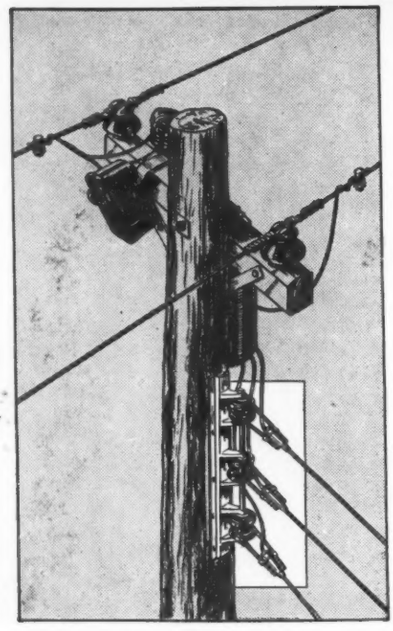
PRACTICE—



Single phase grounded neutral in city distribution.

RELIABLE
STRAIGHT-
THRU
DEAD
ENDS

Reliable Straight-thru Dead Ends with flexible clevis are low in cost and permit the use of hard wire in secondaries. They simplify the take-up of slack — easily installed on either strain or spool insulators.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

New Transformer Lowers Copper Loss

[*Continued from page 61*]

radically reduce exciting current and pave the way for future cost reduction.

New Transformer Design

The new transformer, previously mentioned, is designed to meet the above demands of present-day distribution needs. This transformer and its manner of fabrication are shown in the accompanying illustrations.

The cost of fabricating the core is quite low and air gaps in the magnetic circuit are practically eliminated.

Core steel is not disturbed after the annealing process and, therefore, the steel remains in an ideal state. Such a core is a close approach to the ideal magnetic circuit and takes full advantage of the superior characteristics of low core loss steel in the "with grain" direction. At the same time the exciting current limitation is removed since the exciting current of such a core is very low.

The winding process follows the conventional methods since the wire is pulled onto the form by simply rotating the form flanges. The coils in this type of construction are logically round in cross-section in order to permit rotation in the minimum amount of space. Designers have long desired to use round coils in all sizes of distribution transformers, but heretofore the use of round coils has not been economical in small kva. sizes. In this new construction round coils are economical since the core steel is used much more efficiently than in conventional transformers with stacked cores.

Results and Advantages

1. Exciting current is reduced substantially and the removing of the exciting current limitation has paved the way for changes in ratio of losses.

2. Regulation has been improved. The long solenoidal type of coil used in this construction inherently has low reactance due to the shape of the coil and due to the minimum amount of bulge in the round coil. With lower copper loss and lower reactance regulation has been improved at all power factors.

3. Short time overload capacity is inherently good. The long solenoidal type of soil in which the minimum of surface is enveloped by the iron circuit has a relatively large radiating surface exposed to free oil and, therefore, with other factors equal has a better cooling characteristic.

4. Variations in impulse strength are reduced. Improvement in uniformity of impulse strength is due to the elimination of damage to insulation during the winding of the round coils and to the elimination of further handling that is necessary for assembling the conventional transformer.

5. Elimination of the exciting current limitation paves the way for future cost reductions through improvements in core steel.

Electrical Features of Claytor Dam

[*Continued from page 71*]

windings with which these machines are equipped.

In connection with a co-ordinated system scheme for control of frequency and to provide for possible need for controlling load on the two Glen Lyn-Claytor lines, a complete set-up for frequency and load control has been installed at the Claytor plant. This system is so arranged that any one or two of the four generators at the station may be placed under control to accomplish any one of the following:

(a) To hold system frequency to a predetermined set value regardless of changes in the loading of tie lines or generators.

(b) To hold system frequency to a predetermined set value provided the change in loading necessary to correct for the demanded change in frequency results in a load change in the proper direction to hold the load on the Glen Lyn-Claytor lines within certain predetermined limits.

(c) To hold the load on the Glen Lyn-Claytor lines to a given predetermined set value, without regard as to the effect of this line loading upon the system frequency.

(d) To hold the system frequency to a predetermined set value provided the tie line load does not go outside of a predetermined set band.

(e) To hold the load on the Glen Lyn-Claytor lines to a predetermined set value so long as system frequency

552 Pages of Up-to-Date Buying Data for You!

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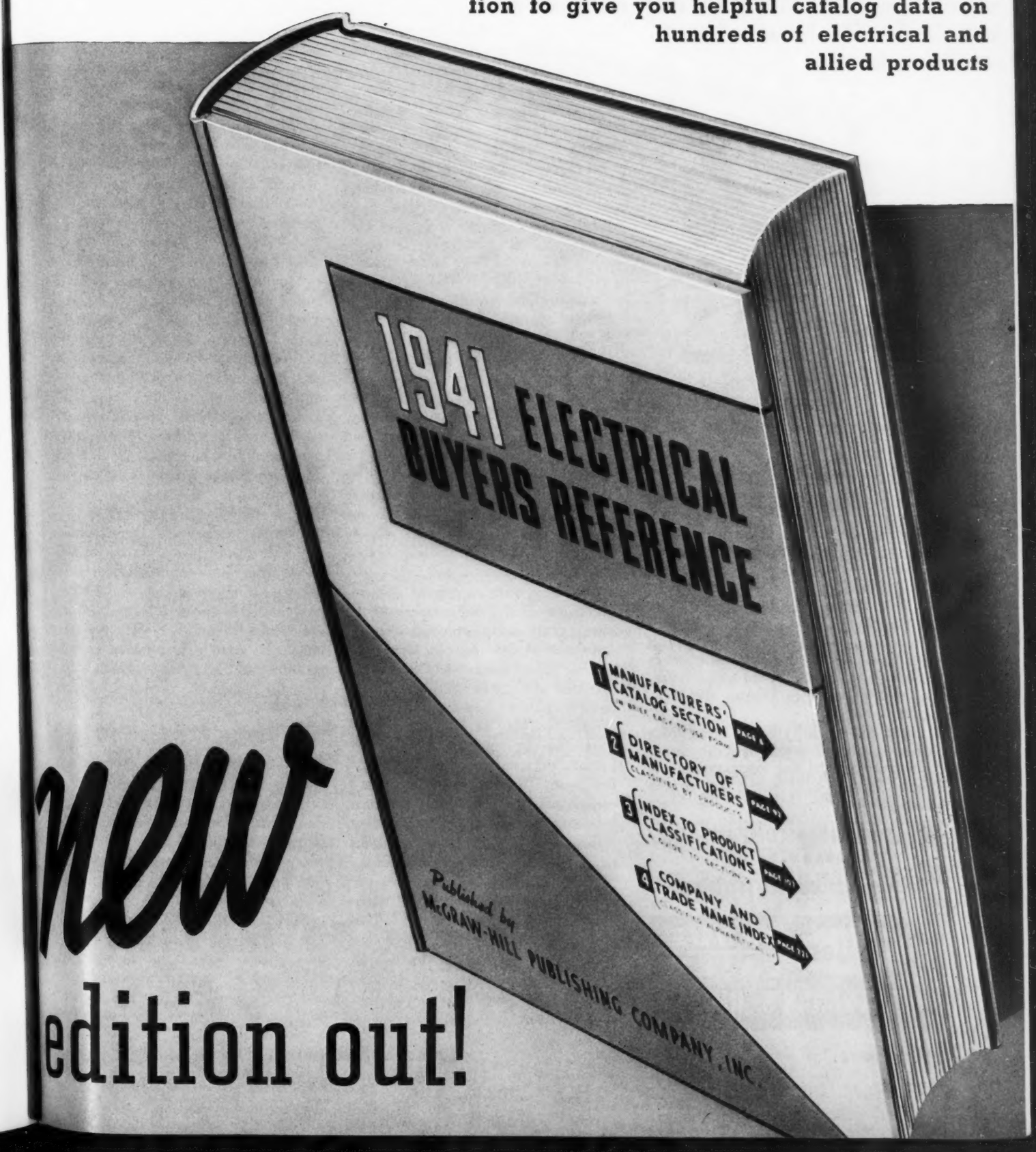

1941 ELECTRICAL BUYERS REFERENCE
1 MANUFACTURERS' CATALOG SECTION
2 DIRECTORY OF MANUFACTURERS
3 INDEX TO PRODUCT CLASSIFICATIONS
4 COMPANY AND TRADE NAME INDEX
Published by McGRAW-HILL PUBLISHING COMPANY, INC.

new edition out!

● There's no such term as "good enough" in the manufacture of electrician's gloves. It's a business that demands Perfection.

In developing the Miller Anode Electrician's Glove we strove for *and attained* high resistance to current leakage, ability to withstand repeated electric tests, greater strength and longer life.

The Anode Process enabled us to make gloves of pure latex uniform in thickness, eliminating thin spots and weaknesses. As a double-check, every glove is examined by trained experts and *samples* of each run are electrically tested.

Best of all, they cost no more than other gloves of equal specifications. Drop us a card for information on prices, sizes and name of dealer nearest you.

MILLER RUBBER COMPANY, INC.
AKRON, OHIO

"Engineers in Rubber"

Miller ANODE LAIEX
ELECTRICIAN'S GLOVES

stays within limits previously determined.

When this control scheme was first cut into service at this plant it was found that, due to the inherent slowness of response of the governing mechanism to the impulses from the frequency controller operating on the synchronizing motor, quite frequently overshooting of the desired load change resulted. In order more directly to control the load changes a scheme has been worked out using a small motor attached to the gate-limit device on the governor, this small motor to be operated directly by impulses from the frequency-control equipment. While this method of control has not actually been tested in service, it is expected that the more direct control of the gates will result in minimizing any tendency to overshoot when the controller indicates the need for a definite load change.

Operation

Claytor plant was placed in commercial operation on August 1, 1939, and has operated under full head since April 20, 1940. During and since that time each of the units and the plant have not only carried full load frequently and easily but they have actually generated up to expected ratings. Early in August of 1940 a flood of about 200,000 second-feet (one and a third times the maximum flood ever before recorded) was experienced. The operation of all the equipment, such as spillway gates, control, baffle walls, etc., was very satisfactory and confirmed the expectations of the designers as to the selection of equipment and the performance of the spillway works.

The plant itself was necessarily operated at reduced heads during the flood because of rising tailwater and, for the four-day period of the flood, generated an output of 7,488,900 kw.-hr., or an average of 75,645 kw. per hour. The project, in short, is a conspicuously successful modern, economic hydro-electric development, co-ordinated with a modern predominantly steam-electric power system.

Design and supervision were carried out by American Gas & Electric Service Corporation, with the authors in general charge and H. S. Slocum as construction engineer on the job. The electrical contractor was Richardson-Wayland Electrical Corporation, Roanoke, Va.

Commercial Cooking Yields $50,000 E.A.R.

[*Continued from page 67*]

and of the commercial cooking equipment itself from the service angle a system of card filing and cross-reference was set up which has proved invaluable in the systematic carrying out of the service technique. Periodic inspection of heavy-duty equipment was administered without cost. In order to be fully prepared for any emergency, training schools were held for the instruction of company service men. The appliance service supervisor was sent to the factories of the manufacturers of commercial cooking equipment for service instruction. In this way a working knowledge of the individual pieces of equipment was possible and any unusual trouble in the commercial cooking field was immediately referred to the supervisor.

A division of commercial equipment was made in two classifications —counter and pantry, which includes coffee makers, toasters, griddles, etc. —and heavy duty, which includes all of the large equipment such as ranges, bake and roast ovens, large broilers, etc. Periodic inspection of the heavy-duty equipment was made from two to four times a year. Inspections are so arranged that during the vacation months of July and August, when all departments are usually working on skeleton forces, few calls are necessary, thereby leaving the service free to answer emergencies. During these periodic inspections minor repairs necessitating only screwdriver or plier use are made immediately and free of charge. If material is found which needs repair work or part replacement, the trouble is referred to the promotional department which contacts the customer.

Customers' Reference Cards

In order to facilitate service calls and to cut down unnecessary ones, a reference card was distributed to all customers. The salesmen made certain that the card was tacked up in every establishment receiving service. This card was entitled "What to do when you need service on your electrically heated kitchen equipment." The card advised checking the fuses; then, if these were found in working order and the equipment would not operate properly, to call the service department. When such a call is re-

Here's A SAMPLE FOR YOU—

of a typical listing in the McGraw Central Station Directory (1940 edition), shown on the other half of this page.

This latest edition of the Central Station Directory lists over 4,000 companies . . . geographically . . . alphabetically. It lists holding companies . . . operating companies . . . municipal plants . . . privately owned plants.

It gives the names of the administrative, managing and operating officials. It shows ratings and types of units in generating plants . . . and so on.

Central stations themselves, manufacturers and distributors selling this field, public service commissions, financial houses—

***all need this* REFERENCE VOLUME**

ceived instructions are given to get as much information as possible so that the equipment for speedy repair might be furnished.

A service truck operated by uniformed service men is available to all commercial cooking customers every hour of the day.

Plans have been made for 1941 to continue this service feature to all commercial cooking customers and, in addition, a monthly cooking publication, broadsides, cooking demonstrations of electric equipment on the premises will all be tied in with the unusual service offer.

•

All-Time Peak Load Hit By Ontario Plant

The all-time peak load of the Kitchener (Ont.) Public Utilities Commission's history was recorded for the electric department in December. It occurred on the 16th at 5.28 p.m. and registered 28,811 hp., exceeding the previous high peak by 650 hp.

Installation of the first 3,000-kva. station transformer at No. 3 station was reported by the manager of the commission.

Kilowatt-hour sales for 1940 increased 6.6 per cent.

•

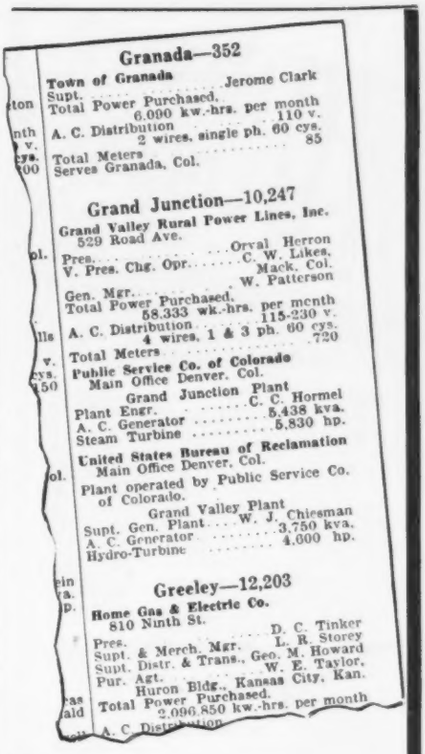
Elects New Officers

At the recent annual stockholders and directors' meeting of the Cook Electric Co., Chicago, Ill., the following were elected as officers of the corporation: G. R. Folds, chairman; W. C. Hasselhorn, president; J. S. Baker, vice-president; C. E. Lundeen, secretary-treasurer; J. F. Jaap, assistant secretary; C. Ruth, assistant treasurer. The company manufactures telephone protection and distribution equipment, heat control appliances and several kinds of electrical apparatus. At the present time the company is allocating considerable capacity to the National Defense Program.

•

EHFA Closes Contract

Electric Home and Farm Authority has announced that a contract has been closed with the Allen-Wells County Rural Electric Membership Corp., Ossian, Ind. The contract provides that EHFA and the utility will co-operate in financing the sale of electric appliances for use by consumers located on the utility's power lines.



Granada—352

Town of Granada ..... Jerome Clark
Supt.
Total Power Purchased.
6,000 kw.-hrs. per month
A. C. Distribution ..... 110 v.
2 wires, single ph. 60 cys.
Total Meters 85
Serves Granada, Col.

Grand Junction—10,247

Grand Valley Rural Power Lines, Inc.
529 Road Ave.
Pres. ..... Orval Herron
V. Pres. Chg. Opr. ..... C. W. Likes.
Mack, Col.
Gen. Mgr. ..... W. Patterson
Total Power Purchased.
58,333 wk.-hrs. per month
A. C. Distribution ..... 115-230 v.
4 wires, 1 & 3 ph. 60 cys.
Total Meters 720

Public Service Co. of Colorado
Main Office Denver, Col.
Grand Junction Plant
Plant Engr. ..... C. C. Hormel
A. C. Generator ..... 5,438 kva.
Steam Turbine ..... 5,830 hp.

United States Bureau of Reclamation
Main Office Denver, Col.
Plant operated by Public Service Co. of Colorado.
Grand Valley Plant
Supt. Gen. Plant ..... W. J. Chiesman
A. C. Generator ..... 3,750 kva.
Hydro-Turbine ..... 4,000 hp.

Greeley—12,203

Home Gas & Electric Co.
810 Ninth St.
Pres. ..... D. C. Tinker
Supt. & Merch. Mgr. ..... L. R. Storey
Supt. Distr. & Trans. ..... Geo. M. Howard
Pur. Agt. ..... W. E. Taylor,
Huron Bldg., Kansas City, Kan.
Total Power Purchased.
2,096,850 kw.-hrs. per month
A. C. Distribution

THIS just gives you a quick idea of the completeness of the listings in the 1940 Central Station Directory. Check it over and see what **more** information you could want to make up market analyses . . . to help salesmen or representatives see the **right** person . . . or for quick reference for that particular bit of information you need. The Central Station Directory is a veritable encyclopedia, one that will save you dollars, cents and time.

•

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for Better, Faster Night Repairs

High Power and Convenience to Increase the Efficiency of Your Line Crews

TYPE "G-23"

25,000 C.P. beam; range ½ mile. Rechargeable Battery. Service filament gives 20 hours continuous light per battery charge, (much longer in intermittent use). High power filament gives 8 hours continuous use. Also available for No. 6 dry cell batteries. Shoulder strap. (Economy light for Watchmen.)

Type "DU"

Projects brilliant work floodlight for manhole and trench illumination and all uses for 20 hrs., or moderate working light for 80 continuous hours (longer intermittently), with each battery charge. Optional reflector for one mile range, 250,000 c.p. beam.

Type "LX"

For general manhole work, repair trucks, etc. Powerful, convenient 1-mile searchlight. Operates from car or any other 6-volt battery. (Floodlight reflector illuminating 10,000 sq. ft. optional equipment).

Type "T"

Roof Searchlight. Inside Pistol Grip Control. Range one-mile. Most powerful automobile spotlight made. Swings in a complete circle, any angle, up or down. Penetrates fog or smoke. Operates from car battery.

• You don't blindfold your line and repair crews in the daytime . . . so why deny them adequate light for night work? 70 Master Lights are available to help you speed up night repairs, end outages more quickly and retain customer goodwill. No more needless groping about in the dark. Types available include worklights, searchlights, floodlights, warning lights, patrol lights, watchmen's lights, and emergency lights for all conditions. 30-day free trial, without any obligation. Send for descriptive literature.

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Master-Light Makers

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Cambridge, Mass.

Quebec Power Units Meet War Production

Preparedness for war production has been the prime purpose of the Quebec power industry through 1940, and the past year has given ample demonstration of the industry's preparedness to meet not only the normal but the abnormal demands which have been made upon it, according to James Wilson, president of Shawinigan Water & Power Co.

New generating capacity totaling 275,000 hp. is rapidly being brought into production, Mr. Wilson stated. Another 200,000 hp. will be freed through curtailing the use of electrical energy for steam raising in the electrochemical industry and the pulp and paper plants; another 50,000 hp. will be saved through other readjustments, as, for instance, the continuation of daylight saving through the winter months. Mr. Wilson declared that increased storage capacity will permit greater output from better river regulation. As a result, he said, there should be available in 1941 for war purposes in the Province of Quebec over 550,000 hp. more than during 1940.

The expansion of industrial production and establishment of new plants to produce war materials and supplies has been largely conditional upon the ability of the power companies to provide electrical energy, Mr. Wilson declared. Not only have the power companies made every practical provision for the rapidly increasing demands for electrical energy within their own territories, he said, but they have co-ordinated their several high-tension systems to insure a much more efficient total power output than has hitherto been thought possible.

•

Month's Electricity Free

Frank C. Lewis, superintendent of the Plain City, Ohio, municipal light and water plant, and the local Board of Public Affairs have announced that no charge will be made to electric consumers of the village for power and light consumed during the February meter-reading period. This is the third consecutive year that Plain City users have received a gift of a month's free electricity.

•

Primary Load Up 4.3%

Hydro-Electric Power Commission of Ontario reports primary load for all systems in January at 1,820,524 hp., against 1,745,926 hp. in January last year, an increase of 4.3 per cent. Primary and secondary loads for all systems totaled 2,025,226 hp., against 2,048,130 hp., a decrease of 11 per cent from January, 1940.

•

Davidson Says Power Needs Are Adequate

In a recent radio address on the subject of electrical power supply and national defense, broadcast over three Omaha radio stations, J. E. Davidson, president of the Nebraska Power Co., told his listeners that there is no need for further spending by the government for plants to produce electric power or transmission lines to deliver it.

"Government money," Mr. Davidson declared, "can best be used for the production of planes, ships, tanks, guns, ammunition and other defense supplies, which should be financed by the government."

The utility industry today has the electric power plants—efficient, dependable and adequate—to meet not only present peace time needs but national defense needs, and it stands ready, he declared, to provide for the future requirements of both.

In emphasizing the utility industry's ability to handle any and all present and future power needs of this country for defense, Mr. Davidson stressed four major facts:

1. Adequate defense requires organized industry supplied with adequate, reliable electric power.

2. Through the private utilities, created by individual initiative and private ownership this country is prepared for the defense power requirements of industry.

3. In this critical period nothing should be done to handicap ability of the utility industry to do its part in national defense.

4. Federal funds need not be diverted from physical armament needs to the building of electrical power plants or lines.

In providing the adequacy of utility capacity (90 per cent of which is privately owned) for defense needs, Mr. Davidson pointed to the fact that last year generating plants of the country produced only 40 per cent of the total engery they could have produced if operated full capacity all the time. Only two-thirds of the country's capacity was in use at any one time, he stated.

He pointed also to the fact that the electrical generating capacity of this country exceeds that of Germany, France, and Great Britain combined and is five times that available when this country entered World War I.

Sales Opportunities

WINONA, MINN.—Mississippi Valley Public Service Co., Winona, plans improvements in local steam-electric power station, primarily in steam division, with installation of new automatic stokers and other equipment. Also will make extensions in transmission lines, including new crossing for high-tension conductors over Mississippi River, with steel towers and other facilities, necessitated by construction of new Mississippi River bridge. Mead, Ward & Hunt, Madison, Wis., are consulting engineers.

NARROWS, VA.—Celanese Corp. of America, Inc., 180 Madison Avenue, New York, N. Y., plans installation of motors and controls, switchgear, duct lines, regulators, industrial lighting apparatus, electric-operated pumping machinery, conveyors and other equipment in new additions to branch mill in vicinity of Narrows, comprising several large one and multi-story units. Cost estimated about $1,500,000. Work will be placed under way soon.

OKLAHOMA CITY, OKLA.—Oklahoma Gas & Electric Co. has plans maturing for new power substation at 10 East Park Place, and will begin construction soon.

DANVILLE, ILL.—Illinois-Iowa Power Co., Decatur, Ill., plans improvements in steam-electric power plant at Danville, primarily in steam division, including installation of high-pressure boiler units and accessory equipment. Also will make extensions in 66,000-volt transmission lines, including new line from Centralia to Venice, Ill., over 65 miles. This is part of 1941 expansion and improvement program of company.

ST. LOUIS, MO.—McQuay-Norris Manufacturing Co., 2320 Marconi Avenue, manufacturer of piston rings and allied products, plans installation of motors and controls, transformers and accessories, duct lines, switchgear, regulators, exterior and interior industrial lighting apparatus, electric hoists, conveyors and other equipment in new plant in vicinity of city for production of armor piercing cores for small arms ammunition for War Department. Plant will consist of large one-story structure and adjoining smaller units, with estimated cost of $4,461,000, including buildings and equipment, about $2,961,000 to be used for latter. Fund in amount noted will be provided by Government for project.

KANSAS CITY, KAN.—Board of Public Utilities has plans under way for expansion in No. 2 municipal steam-electric generating station at Quindaro, to include installation of new 30,000-kw. turbine-generator unit and accessories, condenser, high-pressure boiler with rating of 150,000 pounds of steam per hour, and auxiliary equipment. Cost estimated close to $2,500,000. Project also will include enlargement of switchyard at station, and extensions in transmission and distributing lines. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

WENDOVER, UTAH—United States Engineer Office, 751 South Figueroa Street, Los Angeles, Calif., receives bids (no closing date stated) for power plant and electrical distribution system at Wendover, as per plans and specifications on file.

NEWPORT BEACH, CALIF.—Southern California Edison Co., Los Angeles, plans extensions in 11,000-volt transmission line in Newport Beach district, including line over and across Upper Newport Bay channel, with supporting structures on either side of waterway so guyed to permit removal of electrical conductors over channel to allow passage of craft having a greater height above water line than conductors to be installed (40 feet). Application has been made for Federal permission for channel crossing.

BALTIMORE, MD.—Rustless Iron & Steel Corp., 3400 East Chase Street, manufacturer of stainless steel and allied products, plans installation of motors and controls, duct lines, switchgear, transformers and accessories, electric hoists, conveyors and other equipment in connection with expansion in mill for production of steel specialties for Navy Department. Cost estimated about $800,000. Proposed to begin work at early date.

FLINT, MICH.—Consumers Power Co., Jackson, Mich., plans four new power substations, two to be located at Flint, in addition to another such structure on Pasadena Avenue, in that city, on which work has begun. One of the stations will be located in the vicinity of Hemphill Road, near line of Pere Marquette Railroad, equipped for a rating of 140-kv., where company recently acquired a 20-acre tract of land; and other on Fifteenth Street, adjoining present substation. Another substation is planned near the South limits of the City of Kalamazoo; while the fourth new power substation will be located in vicinity of Francis and South Streets, Jackson, to be connected with substation at Cement City by a new 44,000-volt transmission line. Company also will enlarge present power substation on Adrian Beecher Street, Jackson, with installation of additional transformers, switchgear and auxiliary equipment. Work noted will comprise part of 1941 expansion and improvement program of company, for which a total fund of about $14,000,000 recently has been authorized.

HAZARD, KY.—Kentucky & West Virginia Power Co., Hazard, has arranged appropriation of about $4,300,000 for expansion and improvements in properties during 1941, including power plants, transmission and distributing lines, power substations and other structures. A considerable part of fund will be used for line extensions and improvements, and additional service facilities at Hazard, Ashland and Pikeville, Ky.

TACOMA, WASH.—Ohio Ferro Alloys Corp., Canton, Ohio, producer of ferromanganese, ferrosilicon and other iron and steel alloys, plans installation of motors and controls, electric furnaces and accessories, switchgear, regulators, duct lines, industrial lighting apparatus, conveyors and other equipment in new branch plant on 10-acre tract of land in vicinity of Wapato Waterway, near East Eleventh Street, Tacoma, recently acquired. Contract for power supply has been made with Utilities Department of city on basis of initial load of 650-kw., to be increased later to 13,000-kw. Power substation will be built at plant site. Entire project will cost over $250,000.

•

Nickel Priorities Fixed

Mandatory priority status was imposed on the nickel industry by the Priorities Division of the OPM in an order issued recently.

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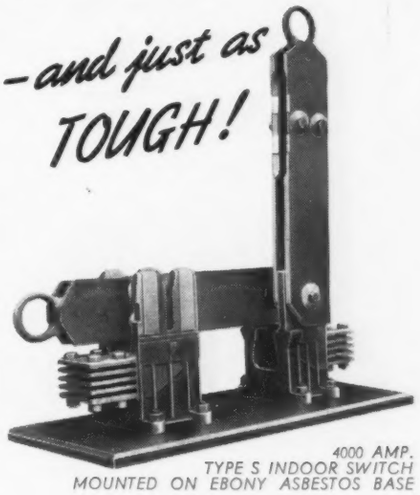

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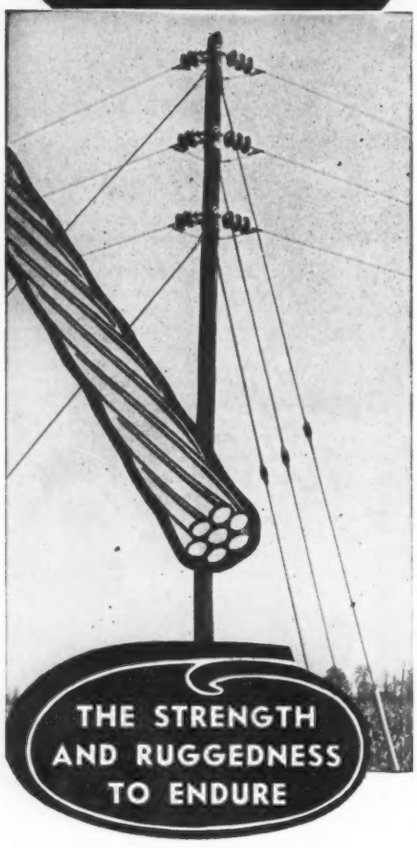

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New Funds Allotted for Rural Projects

Rural Electrification Administrator recently announced an allotment of $250,000 for rural electrification in Texas. This allotment provides for the construction of transmission lines by the Brazos River Transmission Electric Co-operative, Inc., Itasca, Tex., E. D. H. Farrow, president. An allotment of $145,000 was allotted for the enlargement of the Cimarron Electric Co-operative, Kingfisher, Okla., and will be used to build 241 miles of line to serve 466 members in Blaine, Dewey, Major, Kingfisher, Logan, Canadian, and Custer counties. These allotments bring the total allotted by REA since its establishment to $361,502,121.

Other recent allotments follow:

ARKANSAS—Ouachita Rural Electric Co-operative Corp., Camden, William R. Poole, supt., $123,000 to build 131 miles of line. 450 members in Ouachita, Calhoun and Dallas counties.

COLORADO—Yampa Valley Electric Association, Inc., Steamboat Springs, J. T. Franks, supt., $18,000 for installation of mobile generating equipment.

GEORGIA—Georgia Rural Power Reserve Electric Membership Corp., Louisville, J. T. Spivey, president, $36,000 for purchase and installation of two mobile generating units.

ILLINOIS—Eastern Illinois Power Co-operative, Paxton, Terrence M. Brady, supt., $30,000 for member connection fund.

KANSAS—P.R.&W. Electric Co-operative Association, Inc., Wamego, $35,000 for installation of two mobile generating units.

MISSOURI—Atchison-Holt Electric Co-operative, Rockport, Bruce S. Gibbs, supt., $79,000 to build 105 miles of line, 229 members in Atchison, Holt, Nodaway counties, Mo., and Fremont and Page counties, Iowa.

NEVADA—Alamo Power District No. 1, Alamo, Nev., M. A. Bunker, Jr., president, $27,000 to build 21 miles of line, 77 members in Lincoln county.

OHIO—Washington Electric Co-operative, Inc., Marietta, J. D. Murdock, manager, $35,000 for installation of two mobile generating units.

OKLAHOMA—Verdigris Valley Electric Co-operative, Inc., Collinsville, R. H. Bishop, supt., $12,500 to complete the system.

SOUTH CAROLINA—Aiken Electric Co-operative, Inc., Aiken, T. W. Henderson, supt., $8,000 to build 10 miles of line, 33 members in Edgefield and Aiken counties.

TEXAS—Medina Electric Co-operative, Inc., Hondo, T. E. Bredthauer, supt., $100,000 to build 158 miles of line, 290 members in Frio, Medina and LaSalle counties.

WASHINGTON—Lincoln Electric Co-operative, Inc., Davenport, $118,000 for 53 miles of 33 kv. transmission line.

WISCONSIN—Oconto Electric Co-operative, Oconto Falls, Earl G. Redman, supt., $25,000 to build 26 miles of line, 81 members in Oconto and Marinette counties.

WYOMING—Bridger Valley Electric Association, Inc., Mountain View, Van A. Rupe, president, $39,000 to build 39 miles of line, 88 members in Uinta county.

Construction contracts:

TEXAS—Hamilton County Electric Co-operative Assn., Hamilton, Thomas T. League, supt., and Texas Engineering Co., 110 East 10th St., Austin, Tex., engineer, contracts to O. J. Pharaoh, Henryetta, Okla., and J. E. Morgan and Sons, 313 Professional Bldg., Waco, Tex., for building two sections of the system, 198 miles, 318 members, and 271 miles, 393 members; bid, $95,819 and $131,239, respectively.

WASHINGTON—Lincoln Electric Co-operative, Inc., Davenport, C. W. Nash, 203 Plough Bldg., Wenatchee, Wash., engineer, contract to Max J. Juney Co., 418 Hutton Bldg., Spokane, 283 miles of line, 222 members; bid, $190,726.

WISCONSIN—Adams-Marquette Electric Co-operative, Friendship, Wisconsin Development Authority, 522 Tenney Bldg., Madison, Wis., engineer, and James G. Joyce, supt., contract to Capital Electric Co., 148 S. Butler St., Madison, Wis., 76.4 miles of line, 162 members; bid, $47,020.

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Recent Rate Changes

WEST PENN POWER CO. has agreed to cut its rates $1,500,000 annually, the Pennsylvania Public Utility Commission has reported. In announcing the agreement, the commission cancelled hearings which had been scheduled at Pittsburgh and postponed indefinitely the rate case it started against the utility in 1937. West Penn was directed by the commission to file a new schedule of rates to conform to the agreement, but did not fix the filing date. The new schedule must be approved by the commission before the rate cut becomes effective. The utility said that details of the new rates and their effective dates remained to be worked out but asserted that "all classes of West Penn's customers will be benefitted by this reduction in rates."

NEW YORK STATE ELECTRIC & GAS CORP.'s new rate schedule, calling for a $1,200,000 annual reduction of electricity rates, has been approved by the state Public Service Commission. At the same time the utility announced a $2,500,000 to $3,000,000 "change-over" program, transferring the 25 and 40 cycle frequency service to 60-cycle service in certain districts. Meanwhile, the commission announced discontinuance of a previous rate case against the company and ordered it to file a statement of the 1941 work program for the cycle-service change-overs.

PENNSYLVANIA POWER & LIGHT CO. put into effect March 1 a rate reduction of $1,281,000, which affects all consumers taking electricity under the residential and small light and power schedules.

MONONGAHELA WEST PENN PUBLIC SERVICE CO. has put into effect a rate reduction amounting to $200,000 a year. The West Virginia Public Service Commission ordered the cut, effective in April 1 meter readings, as another step in its four-year investigation of rates and practices of the utility.

UNITED ILLUMINATING CO., New Haven, Conn., will give its customers a 40 per cent reduction on their May bills, aggregating an estimated $376,000 reduction. A new rate scale for 56 industrial consumers was also announced. The later rate went into effect February 1 and will result in an annual saving of $25,000 for these industrial companies. The domestic consumer reduction on May bills is in lieu of a rate reduction, which is not feasible because of the uncertainty of conditions everywhere. President James W. Hook of the utility company said: "The rates of the United Illuminating Co. are among the lowest in

the state. We want to keep them that way. But with operating costs and taxes increasing so fast, because of the all-important defense program we must be careful what we do. Under no circumstances must we handle our rate structure in a way that will require us later, when economic activity returns to normal, to ask for rate increases. Our policy, therefore, will be to reduce only when long-time considerations warrant and to share with our customers in the form of a reduction of one or more monthly bills for electricity any special prosperity that may in spite of heavier taxes and other cost burdens come to us as a result of the defense program."

ARKANSAS POWER & LIGHT CO. has announced that by increasing their rate classification through increases in the number of customers, five Arkansas towns will receive reduced electric service bills in the future. Four of the towns, Jacksonville, Ward, Alpena, and Vilonia, changed from Class Six to Class Five of the company's standard rate by increasing the number of customers to above 50. The fifth town, Mountain Home, changed from Class Five to Class Four by increasing the number of customers above 200. Mountain Home reductions will amount to $2.40 per bill per year for residential use, and $1.20 per year per bill for commercial use. In the other four towns the reduction will be $3 per year per residential bill, and $1.80 per year per commercial bill.

CITIZENS ELECTRIC CO., Hot Springs, Ark., has announced reductions in residential and commercial electric rates—residential, $10,917; commercial, $6,443. New residential electric rates range from 5½ cents per kilowatt-hour down to 2½ cents per kilowatt-hour for all in excess of 50 kw.-hr. Present comparable rates are 6 cents and 2½ cents. Commercial rates range from 5½ cents on the first 100 kw.-hr. to 2½ cents in excess of 400 kw.-hr., as compared with 6 cents and 2½ cents now.

WATERFORD ELECTRIC LIGHT CO., Waterford, Pa., has filed with the state Public Utility Commission new rate schedules, effective March 1, which will effect a saving of approximately $4,702 a year. Practically every one of the company's customers is affected. Rates for all classes of service, except heating, cooking and off-peak water heating, are reduced.

ILLINOIS COMMERCE COMMISSION has announced that rate changes effective in the State of Illinois during the month of February resulted in an estimated reduction of $71,798 in annual operating revenues. Electric rate reductions totalled $71,842. Rate increases by two telephone companies account for the $71,798 total for all utilities.

CONCORD ELECTRIC CO., Concord, N. H., has announced a rate reduction, which, on the basis of revenue received in 1940, will reduce prices to consumers by $17,526. Most of the reduction will be in commercial rates, although some revision of tariff will occur in relation to manufacturers and other large users. Domestic rates are not affected in view of their present comparatively low level.

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Named District Manager

Announcement has been made that Percy Jenkins, who was associated with the Wickwire Spencer Steel Co. for more than fifteen years, has been appointed manager of the Boston branch of the John A. Roebling's Sons Co.

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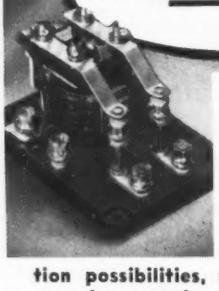

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Recent Legislation

New bills now being considered by the various state legislatures include the following:

ARKANSAS — House of Representatives has defeated a bill by Representative Roy Railes of Mena and others to levy a 3 per cent gross tax on electricity. While the bill specified that the tax was not to be passed on to the consumer, speakers on the House floor asserted it would not have been possible to avoid this. The bill proposed to use funds from the tax for old age pensions. The Arkansas House passed a bill to levy a 2 per cent gross tax on natural gas imported into the state. Senate rejected a bill by Senator Abington of Beebe which would have permitted cities to issue revenue bonds to purchase or construct municipal electric power, water and gas plants. The vote was 12 to 11. A bill by Senator Jeff Bratton of Paragould which would have relieved municipal light plants from securing the permission of the State Department of Public Utilities for line extensions was defeated by the Senate 16 to 14. The bill would have permitted the municipal lines to be extended into a surrounding area within a ten-mile radius.

CONNECTICUT—The bill which will permit the organization of rural electric cooperatives is of particular interest. Other measures being debated are: a bill calling for the popular election of public utilities commissioners, now appointed after gubernatorial recommendations; periodical audits of utilities by the commission; a measure making it less difficult for municipalities to acquire and operate their own power departments. No one appeared to raise a voice in favor of Governor Hurley's pet bill for periodic audits of utilities companies at the expense of those companies. Several appeared in opposition. It was pointed out that this proposed measure is a copy of the New York State statute. Regarding election of commissioners it was argued such a step would require an amendment to the constitution of the state. As for rural electrification as proposed under the REA, it was shown that conditions in this state did not warrant establishment of co-operatives to step up rural improvement. Since May 1, 1932, private companies have built 1,791 miles of rural lines and only 942 miles of additional transmission lines are needed to make electric energy available for all areas. Measures to bar utilities from selling appliances was opposed by utility representatives, distributing companies and the master plumbers representatives.

INDIANA—Legislature has passed House Bill 181, which amends the 1939 public utilities law giving the Public Service Commission and the Securities and Exchange Commission authority to determine ratio of bonds and preferred stock to common stock for additions and improvements. Under the present law, utilities are required to issue 25 per cent common stock. Bill also removes sections of the present law prohibiting utility to go beyond five years of improvements in the issuance of capital stock. Among the new bills recently introduced in the Legislature is House Bill 580, which creates an electrical administrative board of three members and provides for the adoption of minimum standards for electrical equipment and installation and the licensing of electrical contractors, with penalties for violation.

NEW YORK—Bill was introduced in the Senate and a companion bill in the Assembly, amending the public service law, in relation to sub-metering corporations. The

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bill defines the term "electric sub-metering corporation" and then provides for rates and charges as follows: "No gas or electric sub-metering corporation shall directly or indirectly demand, charge, receive or collect a rate or charge for the furnishing or supplying of gas or electricity which shall exceed the rate or charge in the rate schedule of a gas or electric utility operating in the same territory for the furnishing of a like and contemporaneous service under the same or substantially similar circumstances or conditions." In defining the powers of the commission in respect to these corporations the bill says the commission shall have general supervision over them and over all electric plants and gas plants owned, leased or operated by any such sub-metering corporation; examine or investigate the methods, practices, regulations and property employed by such corporations; prescribe uniform methods of keeping accounts; require every such corporation to file with the commission an annual report. A measure, amending the tax law, in relation to aiding municipalities in valuing real property of a public utility, was introduced in the Senate, providing for the furnishing to assessors of any city, town or village, having a population of less than 10,000 and an assessed valuation of less than $10,000,000, upon their written request, the full value of real property in such tax district of a public utility subject to the jurisdiction of the state department of public service. The law, providing for the safety and protection of employees engaged in the construction, repair and inspection of certain high voltage electric lines, would be amended under the terms of a bill introduced in the Senate and of a companion bill in the Assembly.

NORTH CAROLINA—Bill abolishing the popularly elected Utilities Commissioner in favor of an appointed three-man commission was passed. A bill to clear legal obstacles blocking the construction of a $6,500,000 hydro-electric project by the City of High Point, N. C., has been introduced in the General Assembly. The bill provides that the city may go ahead with the project without obtaining a certificate of convenience and necessity from the State Utilities Commission.

PENNSYLVANIA—Measure was introduced in the House by Representative Elmer J. Holland, which would make the real estate of public service companies subject to taxation. Mr. Holland, who has introduced similar bills at past sessions, said that utilities holdings now exempt from taxation is valued at $240,000,000 in Pennsylvania, but the tax valuation of these companies is $8,000,000. The Senate has under consideration a three-way attempt to place under control of the Public Utility Commission all municipal authorities engaged in operating public utilities. Bills were introduced by Senators Franklin S. Edmonds, John M. Walker and Joseph M. Barr to insure "fair rates and eliminate the danger of rackets." Representative Adie S. Rush also introduced two similar measures in the House. Senator Barr introduced a measure to change definition of a corporation in present public utility laws to include municipal authorities engaged in rendering public services. A companion measure would limit such authority power in acquiring and operating what formerly were privately owned utilities by first obtaining public utility commission approval. Senator Edmonds said his measure is designed to "correct mistakes" in 1937 utility laws by permitting appeals from municipal authorities' costs in acquiring public utilities, and from their unsupervised rates.

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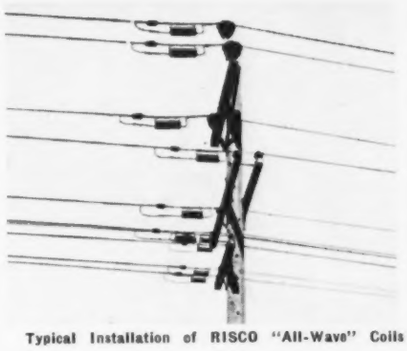

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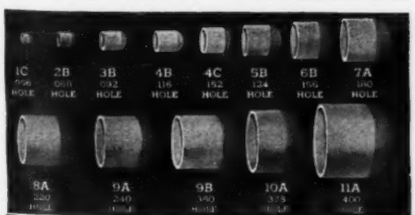

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Always a Power Shortage Next Year

[*Continued from page 74*]

1939, to supplant the National Defense Power Committee, a confidential preliminary report to that committee from an engineer of the Federal Power Commission showed for the thirteen critical war material areas an estimated deficit to meet 1941 wartime demand of 3,260,000 kw. In the *Wall Street Journal* of December 23, 1939, it is reported that, after a conference with public utility experts from these areas, this "shortage" was cut down to 200,000 kw. But a January report to the National Power Policy Committee by the Federal Power Commission engineer calmly boosted the figure to an estimated shortage for 1941 of 1,300,000 kw.!

But in his letter to the President, released December 7, 1940, the chairman of the Federal Power Commission admits that the power demands for 1941 would be met in most cases by existing facilities.

Is this a slip? No, no. It is a continuation of the regular policy. He goes on to say:

> In most areas the full effect of the national defense loads will probably not be felt until the year 1942, when the aggregate deficiencies in available generating capacity in certain areas will probably exceed 1,500,000 kw.

It's always "next year." Congress may not be as smart as it ought to be, but it certainly knows it can't do anything by appropriation to help a power shortage situation "this year."

•

Ohio Public Service Case Postponed by Board

Federal Power Commission has postponed until April 8, the public hearing previously scheduled for February 24 upon the commission's order to show cause, directed to the Ohio Public Service Co., for failure to comply with requirements of the commission's Uniform System of Accounts.

The company, responding to the show-cause order, denied that it is a public utility subject to the jurisdiction of the commission and subsequently requested indefinite postponement of the hearing on the grounds, among other things, that it is engaged in a large amount of work incident to furnishing electric energy for defense projects in north central Ohio.

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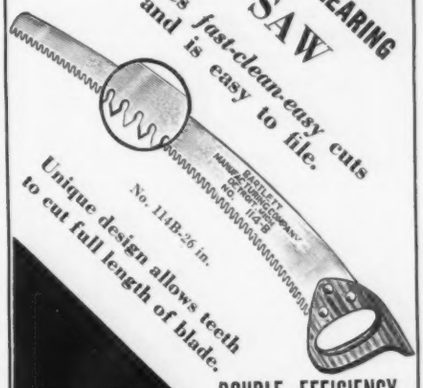

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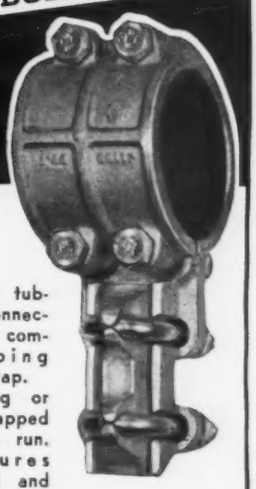

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NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

OFFICIAL PROPOSALS

Bids: April 8 (72)

Switchyard, Transmission Lines, etc.

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
SANTEE-COOPER PROJECT
DOCKET NO. 4329-P-R
MAIN SWITCHYARD, MISCELLANEOUS CONSTRUCTION AND TRANSMISSION LINES

1. TIME AND PLACE OF OPENING BIDS: Sealed proposals for constructing the Main Switchyard, Miscellaneous Construction and Transmission Lines will be received by the South Carolina Public Service Authority at the office of the Engineer, Harza Engineering Company, 27 Cumberland Street, Charleston, S. C., until 10:00 a. m., April 8, 1941, at which time all proposals will be taken to the Ballroom of the Francis Marion Hotel where they will be publicly opened and read.

2. PROCUREMENT OF PLANS AND SPECIFICATIONS: Proposals must be submitted on the forms furnished by the Authority. These forms, including the plans and specifications and other contract documents, may be obtained from the office of the Secretary of the Authority, Room 508, Peoples Office Building, Charleston, S. C., upon payment of $10.00 for the first set and $3.00 per set thereafter. No refund will be made. These documents may also be examined free of charge at the offices of the Authority, Columbia and Charleston, S. C.; at the offices of the Engineer, 27 Cumberland Street, Charleston, S. C., and 205 W. Wacker Drive, Chicago, Illinois; at the offices of the Associated General Contractors, Columbia, S. C., Charlotte, N. C., Raleigh, N. C., Atlanta, Ga.; and at the plan room of the F. W. Dodge Company, Atlanta, Ga.

3. DESCRIPTION OF THE WORK: The main switchyard will be located near the Pinopolis power plant, about 32 miles northerly of Charleston and 4 miles north of Moncks Corner, South Carolina. Two transmission lines will connect the switchyard with North Charleston and Bowman, S. C., respectively. The main switchyard site is approximately one-half mile west of the main line of the Atlantic Coast Line Railroad to which it is connected by a spur track. A one and one-half mile surfaced road joins the switchyard site with U. S. Highway No. 52.

Separate and combined bids will be received on five schedules as follows:

Schedule 1—Main Switchyard and Miscellaneous Construction: This schedule will consist of constructing 12 forty foot, 115 kv switchyard bays and 12 structural steel transmission towers. It includes structural steelwork, ground preparation, concrete foundations and cable tunnel, buses, disconnects, insulators and all work necessary to complete the switchyard except furnishing, wiring and installation of metering and relaying equipment, and furnishing of transformers and oil circuit breakers, which work is being done by others.

Schedules 2 & 5—Transmission Lines: Schedule 2 will consist of furnishing and erecting complete the Charleston Line approximating 30 miles in length and Schedule 5 will consist of furnishing and erecting complete the Bowman Line approximately 45 miles in length. Both lines will be 115 kv, 3 phase, 60 cycle, single circuit, #4/0 Copperweld copper conductor, wood pole, H-type frame construction with overhead ground wires and counterpoise if required.

Schedule 3—Diversion Canal Control Structure: This schedule will consist of constructing and operating a control structure approximately 200 feet long across the Diversion Canal located approximately 15 miles northwest of Moncks Corner, S. C. The structure will include steel sheet piling cutoff walls, concrete base, concrete piers, removable verticle structural steel frames, stop logs and associated items as necessary to complete the control structure.

Schedule 4—Tailrace Transition: This schedule will consist of constructing the concrete transition immediately below the Pinopolis Power Plant.

Lists of prospective bidders and interested parties will be supplied to any manufacturer or person desiring to sub-contract for a part of the work upon application to the Secretary of the Authority.

4. BIDDER'S BOND: Each bid must be accompanied by a certified check or bidder's bond executed by the bidder and a surety company licensed to do business in South Carolina and Countersigned for the Surety by an agent or attorney-in-fact who is a bona fide resident of the State of South Carolina, in the sum of not less than five percent of the amount of the bid. This is required as a guarantee that if the bid is accepted, a contract will be immediately entered into and the performance of it properly secured. The certified check or bond will be returned upon non-acceptance of bid or execution of contract.

5. WITHDRAWAL AND REJECTION OF BIDS: No bid may be withdrawn for a period of thirty days after the date set for the opening of said bid. The Authority reserves the right to reject any or all bids and to waive informalities therein.

6. LICENSES: An act of the General Assembly of South Carolina approved June 2, 1936, entitled "An Act to Regulate the Practice of General Contracting in South Carolina" provides that general contractors (defined as anyone who, for a fixed price, commission, fee or wage, undertakes to construct or superintend the construction of any building, highway, sewer, grading or any improvement or structure where the cost of the undertaking is seven thousand five hundred dollars ($7,500.00) or more) shall file a written application for general contractor's license with the South Carolina Licensing Board for Contractors, Columbia, S. C., said application to be filed thirty days prior to any regular or special meeting of said Board and to be accompanied by $20.00. The South Carolina Licensing Board for Contractors has ruled that, in the case of Schedule 1 which involves a special type of work, the Board will waive the requirement for a Contractor's License.

Bidders must satisfy the requirements of the South Carolina State Statutes regarding annual license tax and license tax on each individual contract, as set forth in Section 2543 of the Civil Code of 1932. Bidder's licenses may be obtained from the South Carolina Tax Commission, Columbia, S. C., price $100.00.

Each bidder not exempted under the above paragraphs will be required to show evidence of the issuance of such general contractor's and bidder's licenses before his bid is opened or considered.

7. VIEWING SITE: Prospective bidders will be given assistance in viewing the site of the work upon application to the offices of the Harza Engineering Company, 27 Cumberland St., Charleston, S. C., or Pinopolis dam site near Moncks Corner, S. C.

By order of the Board of Directors.
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
By TOM B. PEARCE, Chairman
ATTEST:
CHARLES H. GERALD, Secretary